THE
ELECTRICAL REVIEW.

VOL. LXXIII. JULY 11, 1913. No. 1,859.

ELECTRICAL REVIEW.

Vol. LXXIII.] CONTENTS: July 11, 1913. [No. 1,859.

	Page
"Our" Telephone Service	41
Protection for Engineers	42
The Prevention of Fire in Central Stations	43
Lead	43
Half Watt per Candle Lamps	43
Are Hertzian Waves Injurious?	43
British Trade with Canada (*illus.*)	44
Distribution System in Hamilton, Canada (*illus.*)	45
Further Progress in the Development of the Electric Vehicle Business in America	45
Correspondence:—	
The Mutual Protection of Engineers	47
Feeder Resistances	48
Notes from Canada	48
International Electrical Congress, San Francisco, 1915	48
Legal	49
New Electrical Devices, Fittings and Plant (*illus.*)	51
Business Notes	52
A Siberian Wireless Station (*illus.*)	59
Queenstown (Cape Colony) Electric Lighting (*illus.*)	60
Submarine Power Transmission in the Baltic (*illus.*)	61
Notes	67
City Notes	69
Stocks and Shares	70
Electric Tramway and Railway Traffic Returns	70
Share List of Electrical Companies	71
The I.M.E.A. Convention, 1913	73
Electrical Accidents in 1912 (*continued*)	74
The Causes of Fires in Central Electric Lighting Stations and their Remedy	75
Educating the Public in the Use of Light (*illus.*)	77
The "Paragon" Petrol-Electro-Mechanical Transmission System (*illus.*)	78
Proceedings of Institutions:—	
Faraday Society (*illus.*)	79
Electric Marine Propulsion	79
New Patents Applied For, 1913	80
Abstracts of Published Specifications	80

Contractors' Column Advertisement pages xxiv, xxvi and xxviii

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 16, Palmerston Buildings, Queen Street.
BERLIN: Asher & Co., Unter den Linden; Speyer & Peters, Unter den Linden 43, N.W. 7.
BRISBANE: Gordon & Gotch, Queen St.
CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.
DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.
JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.
LAUNCESTON: Gordon & Gotch, Cimitiere Street.
MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto 1° 307.
SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
WELLINGTON, N.Z. Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY
(J. A. Berly's).
1913 EDITION.
H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

"OUR" TELEPHONE SERVICE.

THE British public, having now possessed its very own telephone service for some 18 months, is awakening. It has dawned upon the intelligence of John Bull that perhaps, after all, national ownership is "not all that it's cracked up to be," and that expert management in the hands of a highly developed commercial and technical staff is not so detrimental to the public welfare as he has been told. Indeed, we fancy he would gladly find himself once more within the greedy clutches of the devouring telephone trust, which he has just recently succeeded in parting from its ill-gotten gains under conditions which, if suffered by himself, he would have characterised as extremely unfair.

Last week the growing popular irritation was voiced by the London Chamber of Commerce, which sent a deputation to interview the Postmaster-General on the subject of the injustice of the contracts with subscribers and the inefficiency of the service. Mr. Samuel admitted that the service was not all that could be desired—an admirably diplomatic way of putting the best face on the matter. He also detailed the sums of money that he was spending and would spend on the system, and expressed most praiseworthy views regarding the importance of efficiency rather than cheapness; but kind words butter no parsnips, and, much as we respect and admire Mr. Samuel, who has done his best and deserved well of the country, we cannot accept his soft answers as compensation for the deficiencies of the telephone service.

In London alone, he said, there were one million calls a day—and this he gave with charming inconsequence as a reason why subscribers should accept without question the Post Office record of the number of their calls! He proceeded to say that the number of calls that were ineffective, owing to the lack of sufficient junction lines, was extremely small—less than ½ per cent. But ½ per cent. on a million is no less than 5,000 calls a day wasted through this cause alone, to say nothing of the others—is not this a serious matter?

The *Times* devoted a leading article to the subject on Saturday last, and emphasised the fact that this country lags behind the world in the development of the telephone service. We cannot altogether agree with our contemporary in its references to the cost of the service in London; it is useless to attempt comparisons between the enormous metropolitan area and Continental towns where the telephonic conditions are totally different, and it is unreasonable to demand more than a moderate reduction in the charges, if, indeed, any reduction at all can be effected. It is true that there is no royalty to pay, that the Government can raise capital on better terms than a company, and that there is no restriction to the life of the concern, but the royalty will be more than swallowed up by the inevitable reduction in commercial efficiency which is certain to accompany State control, and it is not correct to say that there is no dividend to pay—the Treasury will not forgo its pound of flesh, and the Postmaster-General, as he indicated in his reply to the deputation from the Chamber of Commerce, will be obliged to provide "a small margin of profit to the Exchequer in consideration of the large amount of public capital involved" (if he can). But as regards the inefficiencies of the service, of which a long list is given, we are at one with the *Times*.

In this connection the attitude of the Telephone Department towards the immense problem with which it is confronted is put in a remarkable light by the statements of one of the secretaries of that department who visited Nottingham last week, to hear the complaints of the Corporation and the local Chamber of Commerce. These statements were published in the *Evening Standard* of June 30th, in which we read that the secretary admitted that complaints were being made on all hands by subscribers. "The service is not what we would like," he confessed; "the telephone system is a worrying business." Oh, for peace and a quiet life! "There are places in London where we do not want any more subscribers, for it would be impossible to give them a good service. . . . People in the West End are continually writing to the Postmaster-General asking for lines, but they are told that they cannot get them, and this is just what they cannot understand." The naïveté of these remarks is delicious. "There are places"—is there any place in London where the existing subscribers get a good service? According to a further statement of this candid secretary, until the end of the year the Post Office can take no more subscribers at Victoria. It may be inferred that the Post Office is not in the telephone business with a view to developing it, but merely to keep things going—to maintain the *status quo*, that fetish of politicians which is born of ignorance and timidity: ignorance regarding the business in hand, and fear of the consequences of a bold forward step. Why will not those West End people be quiet and cease from troubling? Ears have they, says the Post Office, and they do not understand—that they cannot have telephones too. Dolts!

Proceeding, the secretary, with a nerve which commands admiration, if not respect, says that the lack of sufficient provision for future business "was the fault of the National Co." "When the Post Office took up the telephones in 1902, we did not provide for service for the whole of London, expecting that the National Co. would have made ample provision by the time the transfer came into force."

We are at a loss to comment on this remark. As the bargee said in a similar strait, "There ain't no words for it." It appears from further remarks that the Post Office offered to do it and lend the new plant to the company, but the latter most naturally declined, pointing out the obvious fact that if this were done, the Post Office would refuse to buy the company's old plant when the transfer came. "Ultimately we built an Avenue Exchange, and for some time the result of transferring was a ghastly business. For a few weeks there was a very bad time for the Avenue subscribers." Yes; but why say "for a few weeks"? "We have increased the staff of operators . . . . for the moment this seems to be no advantage." The Post Office appears surprised to find that under State management a larger staff is required to do the same work. Every one else knew that years ago, and said it.

"The truth" (there is quite a lot of truth in *this* secretary's statements) "is that at present we are not anxious to advertise the telephones." No need—the subscribers are doing that efficiently.

"We hope that in five years' time we shall have as good a system as that in New York, and we believe that *already we have as good a system as that in Paris.*"

This is a fitting climax to this astounding series of disclosures. It is notorious in telephone circles that the State service in Paris is the last word in inefficiency and mismanagement; the subscribers had to form an association to fight the Government and compel reform.

What do we learn from the foregoing extracts? Is it not that the Post Office entered upon this gigantic undertaking without appreciating the necessities of the case? without due preparation, without co-operation with the company on a reasonable basis, without an adequate staff, without the necessary funds? The department has shown a deplorable lack of foresight and incapacity for handling the tremendous problem which it so light-heartedly took up.

We do not for a moment blame the engineering staff of the Post Office, for the members of which we have sincere respect and cordial sympathy. The fundamental canker is the lack of co-ordination of the administrative and technical staffs, to which we drew attention some years ago, and which results in constant friction and waste of effort. Under the National Telephone Co. the management of the system was in the hands of a machine organised upon a sound commercial basis, by which the highest technical skill and the best business ability were combined and utilised with the utmost efficiency and perfect harmony. The Post Office in taking over the undertaking rejected the best men. Cannot our bureaucrats realise that the best is the cheapest in the end? That a good man is worth a high salary, and can command his own price?

But it is useless to protest; the defects of State control are inherent to the system, and the teachings of history are lost upon the politician, who, of all men, ought to make them his special study. As in England, so it is in France and in Germany; the City Council of Dresden, for example, last month discussed a statement that the Postal authorities threatened to close the telephone exchange for 12 months, to put a stop to the continuous complaints from all parts of the community. The service was described as insupportable, scandalous, and detrimental to the commercial life of Dresden—but the charges had to be paid all the same, in advance. The Council resolved to demand redress from the Postal authorities.

On the other hand, a postal official stated that the alleged threat had not been made—but probably, as in London, the different departments of the German Post Office act in ignorance of each other's movements. To sum up the whole: State management is mismanagement now, as it always has been, and, after all, the people who brought it about have only themselves to blame. We warned them.

Protection for Engineers.

The proposal to form a society for the mutual protection of staff engineers and draughtsmen is one of those subjects which, like the wages of shift engineers, periodically invades our "Correspondence" columns, and invariably evokes an animated discussion. But hitherto, with equal regularity, the attempt to form an association has failed, the numerous difficulties met with by the promoters having proved too great to be overcome with the means at their command. The singular aversion to anything in the nature of a trade union which is always displayed by employés whose vocation lies outside the limits of manual labour may have a good deal to do with it; we are not sure that the feeling is well founded—there is nothing objectionable about a trade union, so long as it adheres to its legitimate objects, and is conducted by honourable men. Moreover, the fundamental principles of trade unionism are to be found in every society formed for mutual assistance and support, whether the members be employés or employers, and there need be no loss of dignity in belonging to such a body. However, the feeling undoubtedly exists, and its intensity is perhaps most marked in the case of men whose work differs only in kind from that of the skilled handicraftsman, and often is actually worth less in point of remuneration.

Other obstacles are to be found in the fear of unwelcome consequences to those who ally themselves with such a society while it is still a weakling, and the difficulty of reaching the eyes and ears of the class of men concerned, many of whom cannot afford to subscribe to a weekly journal, or are too indifferent to their future to concern themselves with the technical Press.

The efforts of existing Societies to take advantage of the agitation on such occasions and to capture the movement with a view to the extension of their own membership, are usually viewed with undisguised suspicion by the coy subjects of their blandishments, who desire to be loved for themselves alone, and not for the sake of their subscriptions. A letter elsewhere in this issue, however, from Mr. W. A. Tookey, draws attention to the advantages of membership of the Junior Institution of Engineers (of which he is vice-chairman), and, we think, deserves the serious consideration of all who are interested in the question.

Mr. Tookey's letter fully explains the policy and organisation of the Institution, upon which, therefore, we need not dwell; but having been intimately acquainted with the

Juniors for many years, we are in a position to confirm all that he says regarding its claims, as one of the most "live" and energetic societies of its kind, to meet the case of the men who are in search of mutual aid. We have examined the Memorandum of Association of the Institution, and find that its scope is extremely wide, explicitly embracing every branch of the profession of engineering and contemplating the promotion of improvements in the law, the advancement of knowledge of persons engaged in the engineering or allied professions, "or in any employment, manual or otherwise, in connection therewith," the encouragement of invention, the establishment of a benevolent fund, and doing "all such lawful things as are incidental or conducive to the attainment of the above objects"—provided that it shall not make itself a trade union. The subscription is one guinea per annum (provincial members, 16s.). The membership is about 2,000.

We believe that the Junior Institution is, in fact, exactly what our correspondents have been looking for, and we strongly recommend them to inquire closely into its merits, lest they go farther and fare worse.

The Prevention of Fire in Central Stations.

Nowadays when the capacity of central electric lighting stations is becoming greater and greater, and where the same plant produces the power required for a steadily-increasing number of different industries, any total or even partial interference with the supply of electrical energy may have results so disastrous that it behoves those responsible for the management of such plants to take every possible care, so that no interruptions may arise. Amongst the causes of accidental interruption in the supply of current, perhaps the one to be the most feared and guarded against is fire at the generating station.

In this connection, we would draw attention to the *résumé* on another page of an interesting article entitled: "The Causes of Fires at Central Stations, and their Remedy," recently contributed to our French contemporary, *La Lumière Electrique*, by M. André Gerard, the engineer of the Société de l'Electricité du Pays de Liége, and a son of the well-known Prof. Gerard.

Among the precautions to be taken in the laying-out of new generating stations, the author mentions the advantage that is to be secured by entirely separating the switchgear from the engine room, and establishing it in a special and independent building. No doubt such a plan would be excellent, if there were not other conditions to be taken into account, which do not permit the switchgear to be entirely separated from the generating plant. We believe that the arrangement adopted at the St. Ouen and Issy generating stations of the Compagnie Parisienne de Distribution de l'Electricité, which, by the way, were described in our issue of the 16th ult., while not being so radical a change, offers all the necessary guarantees against risk of fire. In each of these stations the high-tension switches are installed in a multiple-storey building contiguous to, and communicating with, the power house, a balcony projecting into the latter forming a central controlling point, from whence all the distribution apparatus can be operated, the alternator and feeder panels being arranged in arcs of circles. These stations are almost entirely constructed of reinforced cement, the use of wood not being permitted. In this issue also we print that portion of Mr. G. Scott Ram's interesting report, in which he describes the three important fires in electricity works for which the past year was unhappily noteworthy. In each case the fire originated amongst the cables and quickly involved the switchgear, indicating clearly that this is the weak spot in our present designs. Mr. Ram recognises the great difficulty in dealing with the problem, and suggests that the cables be enclosed in separate channels to prevent the spread of fire; this is good so far as it goes, but does not wholly meet the case. The iron covers which encase the power cables on the London underground railways suggest a practicable method of confining damage to cables in existing stations within the narrowest limits, without waste of valuable space, and the use of ironclad switchgear where possible would obviously reduce the risk of fire.

Lead.

With slightly more plentiful arrivals of lead during the last week or two, the situation has eased to a certain degree, but a considerable proportion of the metal coming in has had to be shipped abroad against old contracts entered into. These supplies had to be drawn from new arrivals, for the simple reason that stocks can hardly be said to exist either in Europe or America. Fresh export inquiries have fallen off during the last week or two to a small extent, but there are important engagements to be filled this month, and about half the quantities arriving early this week will not be available for the English trade. It is quite possible that there may be a renewal of the stringency experienced for near delivery metal, in view of the restricted quantities coming along, though there is no likelihood of anything approaching actual famine conditions being set up. The hopes of consumers continue to be concentrated upon the situation in Mexico, where conditions appear to be settling down, though the process is a slow one. Undoubtedly, had there not been any disturbance in that country, the highest points attained for lead would not have been seen, and the resumption of normal conditions is awaited with impatience. The fact that some lead has come to London from New York has no special significance, and the only complaint of the shippers is that they were not able to get more of it.

Half Watt per Candle Lamps.

The latest development in connection with a low watt consumption per candle-power is reported from Germany, where the A.E.G. intends to place on the market in the autumn a new lamp which is claimed to consume only one-half of a watt per candle, as compared with ·8 watt to 1 watt per candle of the existing wire lamps. It is announced that the Incandescent Gas Light (Auer) Co., which manufactures Osram lamps, will also introduce a lamp having a similarly low watt consumption. The figures, of course, refer to the Hefner candle, which has a value about 10 per cent. less than the English candle.

Are Hertzian Waves Injurious?

Radio-telegraphists, says the *Elektrotechnische Zeitschrift*, are subject to anæmia—a deficiency in red blood corpuscles and their hæmoglobin contents. This malady is traceable to various causes, notably to the faulty location of, and unhealthy conditions in, some operating rooms—particularly on ships. It is not unlikely that the ozonisation of the air round about the high-frequency current apparatus has an injurious effect—this suspicion being confirmed by the headaches, anæmia and bad appetite and digestion of employés in the Niagara and other high-tension stations. It remains to be established whether Hertzian waves themselves have any physiological or pathological action. Dr. Thompson has observed the production of subjective light glimmerings when the head is approached to a powerful electromagnet, and Danilewski has observed muscular contraction in a frog placed near a powerful dynamo; the latter investigator has also noticed that, if the muscles of a frog contract under the influence of electric oscillations to which an insulated man serves as conductor, they cease when the experimenter earths his body. Collins claims that a sleeping cat can be awakened by the influence of Hertzian waves, and that the powerful radiations now employed by many wireless stations have an appreciably injurious effect on operators.

D

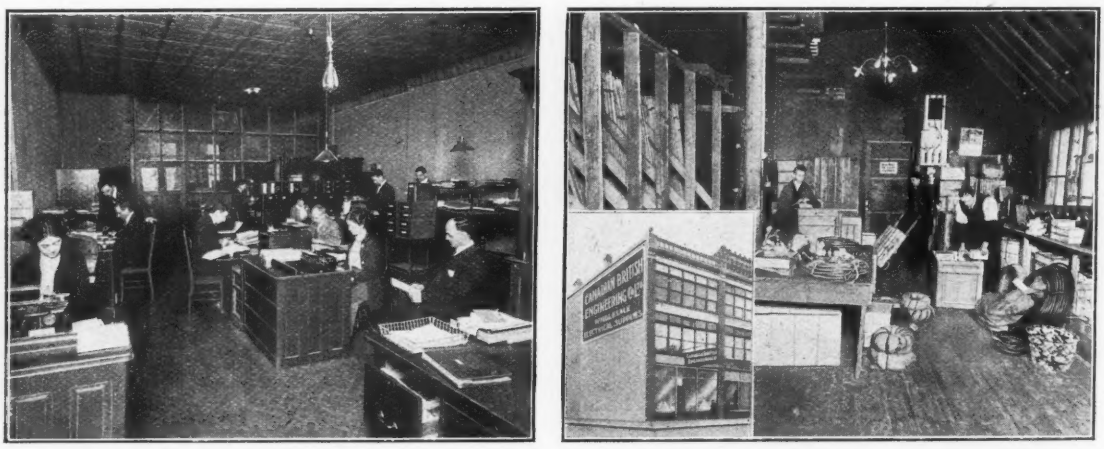
BRITISH TRADE WITH CANADA.

As our readers are aware, for a long time we have made a special feature of the importance of Canadian trade to British manufacturers, and have done our best to arouse interest in the subject and to promote the cultivation of this very promising field. That its possibilities are gradually obtaining recognition is evidenced not only by the rapidly-increasing value of our exports to the Dominion, but also by numerous facts which have come to our knowledge, proving that our manufacturers are devoting more attention to the matter, and that determined and successful efforts are being made to introduce British products to the Canadian market, and we are glad to be able to say that some of the obstacles to our trade in this direction are likely to be removed in the near future.

Some of the difficulties were pointed out in the valuable report of Mr. Hamilton Wickes to the Board of Trade, which we published in our issue of January 3rd, 1913; others were mentioned in our article of May 3rd, 1912, in which we welcomed the advent of the Canadian-British Engineering Co. as affording a good prospect of development. The orginator of the scheme, Mr. Leonard Andrews, had then already spent two years in investigating the conditions, and in formulating plans for the establishment of a satisfactory medium through which British manufactures could be delivered to Canadian purchasers under conditions which would immensely facilitate the speedy execution of orders and ensure satisfaction to the purchaser. With these objects in view, the organisation of his company was so devised as to make it, in a sense, two-headed. An explanation of the telegraph given to an interesting recital of his experiences, the gist of which is given below.

By an extraordinary stroke of good fortune, the directors were brought into touch with a going concern of good standing with a widely extended connection in the engineering world, which was about to come into the market for reasons quite foreign to the business, and were enabled to purchase it *en bloc*, at a price below the market value of the stock alone. Their first care was to reorganise the concern and to rehabilitate its reputation in commercial circles; the business is now in full swing, on the same lines as before, and by itself alone would afford ample occupation for the staff and for the energies of the directors. But naturally, the business done at present is mainly in goods of American origin, whereas the C.-B. E. Co.'s directors are anxious to develop the trade in British manufactures; Mr. Andrews has therefore returned in order to proceed with that undertaking, and Mr. Porter is just leaving for Canada to continue the campaign on that side for a few months.

The commercial methods adopted in the New World differ very markedly from those to which we are accustomed. It is quite useless merely to appoint agents in Canada and to provide them with goods, in the face of the American system. According to the latter, the manufacturer does not confine his activities to supplying his agent with goods; he undertakes the whole of the advertising of his wares and creating a demand for them, leaving the agent to carry a stock, distribute the goods to his (the agent's) *clientèle*, and be responsible to the manufacturer for payment for the goods. The manufacturer also provides expert salesmen to co-operate with the agent's salesmen, the former being capable of discussing points of technical detail with prospective customers—a condition absolutely essential to success. It will



General Office and Shipping Department of the Canadian-British Engineering Co., Ltd., in Winnipeg. External View Inset.

Eastern chief in the old days by one of our pioneers, was that it was like a dog with its head in London and its tail in Afghanistan: "When you tread on its tail in Kabul it barks in London." In a similar way, if a purchaser from the C.-B. E. Co., in Canada, had a grievance which he communicated to the Canadian staff, the London end would take up the matter with the British manufacturer; or if the potential customer explained his individual and peculiar requirements to the staff in Canada, the London office would see to it that his wants were filled to the letter. Thus the Canadian-British Engineering Co. was formed to promote the supply of British goods to Canadian purchasers, by actually impersonating the manufacturer in Canada and the purchaser in London.

The co-operation of a number of important British firms was secured, and the company was duly brought into existence last year. Thereafter Mr. Andrews for the third time proceeded to the Dominion, to complete the overseas organisation of the business, and in the meantime Mr. R. Porter, the company's London manager, has been keeping manufacturers on this side posted with information received from Canada respecting the requirements of that market. Mr. Andrews recently returned after a sojourn of nine months, mainly in Winnipeg, and favoured us with a most

be seen that the difference in method is fundamental and of the greatest importance. The Canadian purchaser, though he has a strong predilection in favour of British goods, is not going to buy them simply and solely because they are British; he must be offered satisfactory inducements to purchase—he must be satisfied that the price and quality are right, and convinced as to the merit of the design in comparison with rival offers—and this can only be done by a man who is fully acquainted with both classes of goods and capable of discussing their points.

Again, the British makers must be prepared to meet their competitors on equal terms. Take, for instance, the case of electric cooking and heating apparatus. Many British manufacturers are ready to guarantee their products for a period of, say, two years; the American in some cases guarantees his goods *indefinitely*. For one thing, they are of good quality; they are made by firms which specialise in these lines, in enormous quantities, so that the cost of manufacture is kept down; and if a utensil lasts, say, two years, the user will consider that it has had a fair life, and will not generally dream of asking for the fulfilment of the guarantee. Thus prestige is secured at a nominal cost. Electric irons and kettles, and cooking ranges, are popular in Winnipeg; they are usually better finished than the British article, with nickel

and polish, and their superior appearance gives them a great advantage, while costing very little.

The company finds that there will be no difficulty in introducing British apparatus and material; as a matter of fact, its travellers are keen to take them up, for they find that "British-made" is a good "talking-point," which arouses the interest of their clients and facilitates business. Moreover, municipal inspectors of electrical apparatus are, in many cases, quite willing to approve of British material and accessories, even without the imprimatur of the Chicago Board of Underwriters, provided that the goods bear the brand of a manufacturer or distributor of repute. Again, if the selling price of an article in London is the same as, say, in Boston, from which centre many electrical appliances are imported into Canada, it can compete with the United States product in the Prairie Provinces on equal terms, as the combined freight charges and preferential tariff on British-made goods are approximately the same as the lower freight charges and higher tariff on U.S.A. goods. Energy is extraordinarily cheap in Winnipeg—$3\frac{1}{3}$ cents per unit, flat rate, for lighting, and 1 cent for heating—so that there is an excellent field for the sale of consuming appliances, provided that they comply with standard requirements; for instance, lamps, &c., must be fitted with the Edison cap, as the bayonet cap is practically unknown in Canada.

The company has already a large business in Winnipeg, provided with the necessary office staff and travellers, and branches in other centres. It is in a position to deal with British goods right away. But it is of no use, as we have shown above, to supply the goods alone; the aid of experts is essential, to explain the good points of the stuff to the purchaser. The company, therefore, invites manufacturers to co-operate with it on the following basis:—The company will provide the necessary office accommodation at its own cost—no small item in Winnipeg—and will place at the disposal of the manufacturer its existing organisation and distributing network, while the manufacturer is asked to appoint and pay the salaries of experts who can talk about the goods with technical knowledge and cope with the eloquence of the rival "spell-binders." A similar system is already in operation and has afforded good results in India, and in view of the extraordinarily rapid development which is taking place in Winnipeg and the adjoining areas, in which the company is already favourably known, there is every reason to anticipate still better results from the co-operation of manufacturers with each other and with the Canadian-British Engineering Co. The company already have over 500 customers on their books in the Prairie Provinces alone, many of these customers being very large buyers of engineering plant.

The directors of the company have set themselves the task of developing the system on the lines above described, and they have our best wishes for their success in a venture which promises well, not only for those associated with them but also for British engineering trade in general.

DISTRIBUTION SYSTEM IN HAMILTON, CANADA.

By W. A. COATES.

As reported in the Electrical Review last autumn, the City Council of Hamilton, Ontario, has decided to lay underground all wires at present carried overhead within the main business area of the city. This area is considerably less than 1 sq. mile, but the cost of the change is estimated to be about £50,000.

The authorities chiefly concerned are the City Hydro-Electric Power Department, the Dominion Power and Light Co., the Bell Telephone Co., the Western Union Telegraph Co., and the City Fire and Police Departments.

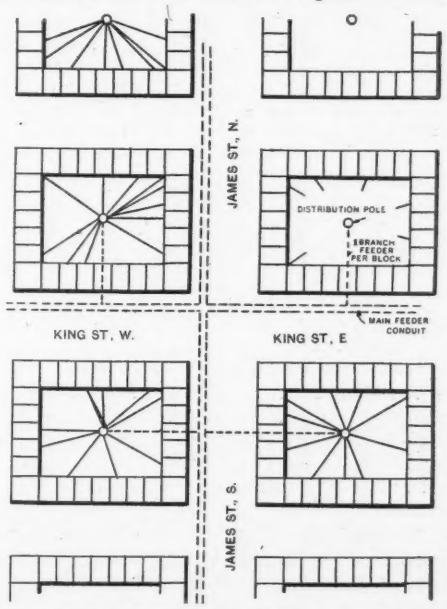
The proposal is for the Bell Co. to install their own conduit system, while the city authorities will undertake the laying of conduits for all other parties concerned, charging each with their proportionate cost.

The system of distribution to be adopted is not a fully underground one, but will be as shown in the sketch plan.

The conduits will be laid along the main streets, only one branch being taken to each block of buildings. In the centre of each block, and consequently out of sight from the street, a distribution pole will be erected, from which aerial feeders will run to the individual consumers. This scheme will avoid tearing up the footpaths to any great extent, and, more important, will obviate the necessity for changing the wiring of buildings. These are all arranged with the incoming feeder at the top of the building, and not in the basement, as is customary with fully underground systems.

This method of distribution is one deserving of careful consideration in many of the smaller English towns. It is more economical than a fully underground system, and yet retains the advantage of good appearance from the road.

Mr. Gaby, the chief engineer of the Hydro-Electric Power Commission, of Ontario, has recently made an extended European tour, and on his return is reported to have said



that he was most impressed by the neat appearance of the towns, due to the absence of overhead wires. He expressed the opinion that a like state of affairs must eventually exist in Canada. So far as we are aware, Montreal and Hamilton are the first cities to make any definite move in this direction. In both places the work of changing over is to be tackled this year.

FURTHER PROGRESS IN THE DEVELOPMENT OF THE ELECTRIC VEHICLE BUSINESS IN AMERICA.

By DOUGLAS SUTHERLAND MARTIN.

When he reads in the English papers of the wonderful faith which has inspired the banding together of the "Point-Fives," of the heroic efforts in the production and marketing of excellent off-peak apparatus, such as flat-irons and cooking ranges, and the degree of expansion which has actually been secured as the result of these efforts, the American reader is filled with wonder at the apparent disinclination of the new-business agents of the central stations in England to tackle seriously the electric vehicle business, and at least to find out by actual practice whether there is, or is not, a wealth of off-peak revenue to be obtained from it. Because in America by now the thin edge of the wedge has been surely driven in, and every succeeding year will see big increases in the sales of electrics, with a corresponding revenue to the central stations and an improvement in the load factor.

The writer had occasion to look closely into this matter for the first time two years ago, and some of the results of his study of the American situation were given in an article which appeared in the London Electrical Review in November, 1911. Since then he has followed with increasing interest the doings of the men who are behind the electric vehicle business in America, and, even in the comparatively short time which has elapsed since the publication of that article, has been able to witness, in common with any other observer of the commercial situation here, a really

wonderful progress in the driving home of the wedge. To those who are interested in the matter the writer would like to suggest that a study of these rough notes on recent progress in the development of the electric vehicle business in America could be made more profitable by a glance at the data and opinions given in his earlier article.

The reason for the apparent inaction in English supply circles might previously have seemed to be due to some doubt as to the possibility of the electric vehicle; and, in the then unsatisfactory state of the home market, to a justifiable desire to stand off from a speculation in these possibilities until, at least, some data and proof were forthcoming which would show that, with the right kind of campaign, the game was really worth the candle. Any such doubts have been long since dispelled. The American interests have furnished the proofs, and are now proceeding month by month to pile up fresh evidence of their wisdom and foresight; their courage and enterprise were never in question. Now that such splendid work is being accomplished in England in popularising electricity for domestic uses other than mere lighting, is it too much to hope that central station managers will soon begin to boost for the electric vehicle? Do they realise that the load factor of the average commercial electric is at least 30 per cent., against, say, 10 per cent. for the average industrial motor? Do they appreciate that a single 2-ton electric truck, in regular operation through the year, represents an income to the station equal to that from 86 flat irons, while representing a connected load, and therefore plant equipment, of only one-eighth that of the 86 irons? A paper which was recently presented before the Electric Vehicle Association of America, by Mr. H. W. Hillman, contained some very interesting information along this line. By means of a census of 30 central stations situated in cities ranging in population from 1,000,000 down to 25,000 inhabitants, the author of the paper compiled a table showing the relative annual income per kilowatt of the necessary plant equipment for a wide variety of loads. In his list were included large and small residences, small retail stores, churches, drug stores, industrial power installations of one, two, three, eight and twenty motors, saloons, and a 2-ton electric truck. It should be carefully noted that the revenue from the 2-ton truck was found to be second only to the saloon and the drug store. This table, and the conclusions based upon it, attracted considerable attention, and certainly furnished a striking indication of the wisdom of those supply companies who have taken at least some measures to cultivate the truck business, while, of course, not neglecting the other items enumerated in the classification. They had known of this relation before—had known that it was economically unsound to spend all their time and advertising appropriation in the cultivation of loads in which the overhead charges were always, and inevitably, high, and which could not always be regarded as profitable.

It would be idle to imagine that there is anything like a gold mine in this vehicle business, or that it can be acquired without a lot of hard work; and the English concerns which are thinking of entering the field actively will do well to learn all they can from American experience, and thereby profit from the troubles of the pioneers, even if they can take none of the glory for frontier enterprise.

The difficulties to be encountered are such that great faith in the possibilities of the vehicle load is needed before any good is likely to come—the kind of faith which is willing to devote a considerable percentage of a year's earnings to a publicity campaign, the results of which may not be apparent for three or four years. Even in Boston, the city which, of all others, has done the most meritorious work in popularising the electric vehicle, there were, at the end of 1912, only about 300 commercial vehicles in service; although, when noting that figure, the reader should bear in mind that it has grown from 120 in 1910, and from 10 in 1905. The English new-business expert can figure what this would mean in his own city, in an English city of a size comparable to that of Boston—say, Greater Birmingham. If we assume that five years' steady work in Birmingham would result in placing 100 electric trucks in service, and that the charging of these vehicles would provide an average annual load of 6,000 KW.-hours for each truck, we see that this would result in an income of £5,000 a year, taking a rate of 2d. per KW.-hour. From that point on, the revenue should increase easily at a rate of anything between 50 and 100 per cent. per year. At least 90 per cent. of the charging takes place at off-peak hours. Are this revenue and this load worth having?

Mr. Arthur Williams, the President of the Electric Vehicle Association of America, reports that in New York the number of electrics grew by 45 per cent. between the summers of 1910 and 1912, and that in the last two years electric trucking in Chicago has increased by no less than 400 per cent. In this country there are now 30,000 electric vehicles in service, 10,000 having been built in 1912—6,000 pleasure cars, and 4,000 commercial wagons. An output of 15,000 is predicted for 1913. By the end of 1915 there will very likely be 100,000 electrics in service on the streets and roads of America, giving an aggregate charging load of something like half a billion kilowatt-hours a year. There is no question as to the commercial value of such a load to the whole of the electrical industry; and, whatever progress may have been made in other directions, it certainly is difficult to sympathise with any policy of inaction in this particular field, which holds out such bright promise of an accretion of hard cash. Instead of having to commence an active campaign in 1913, the American electrical men have now their plans in nice working order, with sufficient practical experience gained in the last few years to enable them to tackle the remaining opposition intelligently, with a maximum of efficiency and a minimum of wasted effort. Apparatus is now available which, on a fair showing, runs no risk of stultifying the rosy claims which are made for it; gasolene is steadily rising in price, and horses are becoming more costly as the demand for them diminishes; rates for electrical service—especially for the off-peak demand—are dropping year by year. Ten years ago the owner of an electric had to pay anything over 20 cents per kilowatt-hour for charging his batteries. To-day he can, in most localities, obtain his supply at 3·5 and 4 cents, and in but rare instances does he have to pay as much as 5 cents. After much hard work and an unremitting energy in making representations, the Electric Vehicle Association of America, has succeeded in convincing the underwriters of the reduced fire risk associated with the electric vehicle, as well as its general safer operation and control; with the result that the insurance companies are beginning to revise their schedule of rates, and in some instances are quoting figures for the electric which will bring the annual percentage for insurance some 20 per cent. below the figures for gasolene cars and wagons. There is no lack of talking points for the electrical man. He now has everything in his favour; and, if he has troubled to equip himself with all the arguments which now stand to the credit of his apparatus, he need be afraid of no opposition.

Boosting the popularity and application of the electric vehicle presents one of the most conspicuous instances of the advantages of—or even the necessity for—the active co-operation of the various interests who stand to gain from such boosting—the central stations, the garage proprietors, the vehicle makers, and the manufacturers of the electrical equipment. Such co-operation is the first essential, and without it the rate of progress is bound to be slow, and may dwindle to a value closely approximating zero. If it is realised, the rate of progress, as we have seen, may be expressed in percentages of several hundred. There is no space here to deal with all the difficulties which are to be encountered in building up an electric vehicle industry, and how they may be overcome by the assistance of full and intelligent co-operation; nor to show in how many different directions the Associations making for such co-operation in this country—such as the Electric Motor Car Club of Boston, locally, and the Electric Vehicle Association of America, nationally—have been able to secure results. The figures are sufficient proof of the success of their efforts, and some of the things which they have been able to achieve have already been briefly touched on. Two further instances may be cited in this article, since they relate to the solution of the two most persistent problems which the pioneers in this country have been called upon to handle—the collection of concrete comparative data regarding the performance of electrics, gasolene vehicles and horse wagons; and the establishment of adequate garage and charging facilities for the users of the electric car or truck.

It is no uncommon thing for the manufacturer of electrical and other merchandise to support costly laboratories, and to stock them with a well-trained staff of scientists and engineers who pursue various lines of research connected with the materials which the manufacturer handles. It sometimes costs a lot of money, but it gives the manufacturer a standing, and generally means money in his pocket in the long run. The work of the laboratory resembles the work of a university very closely, and it is usually difficult to detect any trace of the commercial atmosphere about it. It is a more uncommon thing to find the university actively engaged in research along a line which is with difficulty separated from frankly commercial matters. Often the research faculty in the university is maintained not so much with an idea of discovering anything new, or of providing data which are going to be of any direct economic benefit, as to teach the student *how* to investigate; and in many schools the same old lines of work are followed year after year by succeeding groups of aspiring young engineers, who thereby learn how to research, but do not succeed in increasing the sum of knowledge at the disposal of mankind. In other, though infrequent, instances, they prosecute a line of study, the results of which are directly to be applied to the solution of a problem which is baffling someone in the commercial field, who may not possess the necessary funds and facilities himself for finding a solution.

Such study seems worth while; and no more striking instance of its commercial value can be furnished than is given us by the contemplation of the work of a group of men at the Massachusetts Institute of Technology, Boston, working hand in glove with the local electric supply company—the Edison Illuminating Co., of Boston. One of the greatest handicaps which the sponsors of the electric vehicle have had to face has been the lack of performance data on the cost of trucking. Usually they have had to confine themselves to generalities; and in any case their arguments have always been less convincing than they might have been had any authentic set of comparative figures been available. The Boston Edison Co., of course, were well aware of this; and they have, therefore, been placing money at the disposal of the College Laboratory, in order that the latter may go ahead and actually find out to what degree the electric is superior to the gasolene and horse truck, and what kind of a dollar-and-cent talk can be handed out to the merchant in endeavouring to get his name to a contract. This work is still being carried on, and only recently has begun to yield results of value; but already the expenditure has been amply justified, and the contributions which have emanated from the Boston Technical Institute, from Prof. Pender, Mr. Harry Thomson, and others have been amongst the most valuable which the electrical vehicle people have ever obtained. Reports have from time to time been given, and there will be many more such publications in the future—consisting for the most part of analyses of actual field costs taken from the records of local concerns in the territory between Boston and St. Louis. Over 100,000 observations have been made upon the speed-time performance of road transportation equipment; and it is believed that within a few months the Massachusetts Institute will have analysed enough operating data from actual street service to furnish a basis for the predetermination of costs with fair accuracy. All this is work of the greatest commercial importance. Before the sales of electrics can amount to anything really worth while, it is essential that the vehicle men shall have the data ready to show to the merchants, and present the data to them in the only language in which merchants care to discuss the matter—the language of the dollar. We are now on the way towards such a condition; and we may find here a very eloquent symbol of the value of co-operation.

(*To be concluded.*)

New Cable Factory.—A new factory for the manufacture of electric cables and insulated wire was registered at Helsingfors, Finland, on December 5th, 1912. Hitherto all such articles have been imported.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Mutual Protection of Engineers.

I have noticed for several weeks past in your columns letters from a number of your readers who are particularly interested in all that pertains to the advancement of those who desire and deserve suitable employment at an adequate rate of remuneration, and who are also keen to take advantage of combined action such as an institution or society would offer to its members in this respect, as well as in the equally important matters of technical improvement and social intercourse.

In none of the letters from your correspondents do I find any reference to the good work that the Junior Institution of Engineers is doing in this connection, and it has occurred to me that the present is a suitable opportunity of stating briefly the aims and objects of this flourishing body, and of mentioning the unremitting efforts of its Council in doing all that is possible for the welfare of its members.

Being established by the young men of the engineering profession for their own benefit, it has ever been essentially an institution for "juniors." Its members are recruited from all branches of engineering—civil, mechanical, electrical, mining, shipbuilding, surveying, heating, illuminating, and so on. Many members of the Senior Institutions are proud to retain their interest in the "Juniors," and a tribute to its position in the engineering world is to be found in the fact that many of the most eminent engineers and scientists have esteemed it a great honour to have been elected as its president.

The Junior Institution is governed by a Council elected by members. There is no "official list." There are no freeholds on the governing body. Every councillor serves but for a period of three years, and two years must then elapse before a past councillor can again become eligible for re-election. I mention this as, in the opinion of many "Juniors," the rule explains why the Institution is ever growing and never stagnant.

The thirtieth anniversary of its foundation was celebrated on June 30th last. The Junior Institution of Engineers can, therefore, claim to be thoroughly well established. Its membership is steadily rising to the completion of its second thousand, and it is represented throughout the United Kingdom and the British Dominions, and, indeed, throughout the civilised world. The "atmosphere" of the Junior Institution is unlike that of any similar body. Its camaraderie is a by-word, and all its many activities are thoroughly successful because of the "verve" of its governing body and the whole-hearted support of members generally.

Very few are to be found who relinquish their privileges as members once they have joined its ranks and have participated in its meetings, visits, discussions, and other technical and social events.

Any member in need of technical assistance has only to write to the secretary, who promptly puts him into touch with a fellow member whose knowledge is at the disposal of his colleague for the benefit of the Institution. Discussion evenings are held at the offices throughout the winter session—October to May—every Friday evening, when members associate without formality and seek and impart information upon various subjects of topical and professional interest, specially chosen with a view to assisting those who desire to add to their technical abilities.

In connection with the Junior Institution, an "Engineers' Register" has been inaugurated with the object of securing suitable appointments for those of its members who may be out of employment, and of obtaining posts for those who, being in employment, yet desire a change for the better. All such services are provided free of expense to members. Since the inauguration of the scheme, the Institution has been able to secure posts for all who have applied for appointments, and, as a matter of fact, more applications have been received from employers for men to fill vacancies than the secretary has received applications from employés.

In order that these few facts should be fully realised and appreciated by your correspondents, I hope that you, Sir, will be willing to find room in your columns for this letter.

W. A. Tookey.

London, E.C., *July 4th*, 1913.

[We refer to this matter in our leading columns to-day. —EDS. E.R.]

Feeder Resistances.

For the coming winter I shall require resistances for feeders for use during the winter peaks, to carry from 50 to 200 amperes, with voltage drop of about 40 volts, which should be obtainable at any of the above currents. The drop of voltage should be easily regulated within reasonable steps, so that the resistance may enable the correct pressure to be kept at the feeder end.

No doubt the problem has been faced by many stations, and I shall be very glad to have details of successful solutions to the problem. It would be quite easy to fit up elaborate resistance frames with regulating switches, but as the resistances will only be needed for a few hours in the year during the heavy peak loads, it is desirable that the apparatus should be as cheap as possible.

Feeder.

NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

FOR some time past the question of adopting tubes as a solution of the traffic problem in Toronto has been debated, and now a consulting engineer in Montreal has forwarded a report to the Board of Control of that city, recommending a similar solution for the traffic difficulties there. He believes that by expending some $20,000,000, a gross revenue of $3,000,000, and a net one of half that amount, could be obtained in the first year. The expenditure would cover the cost of an underground tube system having 12½ miles of double track.

The Dominion Government has arranged to construct a new Welland Canal, on which $50,000,000 will be spent during the next five years. Though not directly of interest to electrical men, it is one of the big engineering undertakings of the country, and is an indication of the growing importance of this great land. The present Welland Canal, joining Lake Erie with Lake Ontario in a course approximately parallel to that of the Niagara River, is too small, hence the need for a new one. This will have only seven locks, instead of the 27 at present in existence, and the locks are to be 800 ft. long × 80 ft. wide, and to have a 30-ft. draft capacity. The existing canal route will be followed for a portion of the distance.

The Dominion Power and Transmission Co., of Hamilton, Ontario, are going to spend $1,000,000 on an auxiliary steam plant.

As a result, no doubt, of the investigation made recently by the Dominion Government (already mentioned in these notes) as to the feasibility of utilising the great lignite beds of Saskatchewan for power purposes, one of the owners of extensive lignite deposits in the southern portion of that Province is reported to be forming a company with $1,000,000 capital, to generate power from the lignite.

The great dam being constructed by the British Columbia Electric Railway Co. on the Jordan river, to which also reference has already been made, will be finished next month. It is expected that 14,000 more horse-power will be available owing to this dam, which is 800 ft. long, and which has a maximum height of 135 ft.

At Kamloops, British Columbia, the ratepayers have decided to spend $260,000 in erecting a hydro-electric power plant on the Barriere River, about 40 miles away. An extension of the electric lighting system at a cost of $120,000 has also been decided on.

Medicine Hat, in Alberta, is to have an automatic telephone exchange for 10,000 subscribers; this will be built by the Provincial Government. Port Coquitlam, B.C., is also considering the question of having a similar system.

A steam-driven generating station, equipped with water-tube boilers of 5,000 H.P. capacity and turbo-alternators, is proposed for Prince Albert, Saskatchewan.

An additional oil engine and generator, estimated to cost about $50,000, will probably be purchased by the City of Vernon, B.C., this year.

INTERNATIONAL ELECTRICAL CONGRESS, SAN FRANCISCO, 1915.

PRELIMINARY plans for this Congress, which is to be held during the week beginning September 13th, 1915, in conjunction with the Panama-Pacific International Exposition, and under the auspices of the American Institute of Electrical Engineers, are being prepared by the Committee on Organisation. In the week preceding the Congress there will be a meeting of the International Electrotechnical Commission. The Congress is being divided into 12 sections as follows:—

1. *Generation, Transmission and Distribution.*—Central station and sub-station design, control and operation. Long-distance transmission of electric power.
2. *Apparatus Design.*—Generators, motors and transformers. Prime-movers and their relations. The rating of machinery.
3. *Electric Traction and Transportation.*—City, surface and rapid transit railways; inter-urban and trunk lines; electric vehicles, ship propulsion, mining railways, elevators and hoists.
4. *Electric Power for Industrial and Domestic Use.*—Factories, mills, refrigeration, heating devices, &c.
5. *Lighting and Illumination.*—Arc and incandescent lighting; the science and art of illumination.
6. *Protective Devices; Transients.*—Switches, circuit-breakers; condensers; electrostatics; disruptive phenomena; high frequency phenomena.
7. *Electrochemistry and Electrometallurgy.*—Electrolytic and metallurgical apparatus and processes.
8. *Telegraphy and Telephony.*—(*a*) All communication of intelligence by the use of wires. (*b*) Electromagnetic waves and radio-telegraphy and telephony.
9. *Electrical Instruments and Electrical Measurements.*—Switchboard, portable, standard and absolute instruments. Testing and standardisation methods; absolute measurements.
10. *Economics of Central Stations and Systems.*—Load factors, power factors and all problems affecting the economy of central stations; also rates and regulation by public service commissions.
11. *Electro-Physics.*—Radio-activity; Röntgen rays; gas and vapour conduction; electron theory; constitution of matter.
12. *Miscellaneous.*—Such as History of literature of electrical engineering; symbols and nomenclature; engineering education and ethics.

In each section it is desired to include as many as practicable notable papers dealing with the status or the progress of the art. Offers of papers and suggestions in this connection should be directed to the Secretary of the Committee on Organisation, Dr. E. B. Rosa, Bureau of Standards, Washington, D.C.

Lead.—MESSRS. JAMES FORSTER & CO., in their lead report for July 5th, say: "The effect of the 'bear' raids of last week on this market is gradually wearing off, and values have appreciated this week about 15s. per ton, up to £20 having been paid for July delivery and £19 17s. 6d. July shipment, and for August £19 5s., the closing prices last night being a little easier at £19 15s. July, with sellers for June shipment at £20. Arrivals here for June are just about 7,000 tons, against an average of about 10,000 tons, and even so a large proportion of the arrivals have been shipped abroad. About 2,000 tons are due to arrive early next week, and we estimate that of this about 1,000 tons will be re-shipped. There is no evidence of any existing stocks at any of the providing centres, and to supply June contracts 400 tons of lead is arriving from America, shippers admitting that they would have liked more of it. There has been a good demand from consumers, and a considerable quantity has been booked for the Continent. After next week's arrivals we anticipate a renewed pressure for early lead."

Argentina.—The report of the Société de l'Electricite de Rosario for last year states that the old generating station has been relied upon to maintain the service, but that, although run at high pressure, it was unable to meet the whole of the demand. Two drawbacks were experienced during the year—the high cost of coal owing to the strike in England and—an unusual cause—an invasion of light-attracted insects during the summer months, which forced inhabitants to make as little use as possible of artificial lighting. The new Sorrento station of the company in Rosario, which will eventually have a capacity of 40,000 KW., was put in operation at the commencement of 1913, to the extent of 18,000 KW. The current generated is three-phase (6,000 to 6,600 volts), this being transformed in four sub-stations to continuous current for the running of the tramways and for lighting in the districts formerly served by the old station. In the new districts to be supplied, the mains will be directly fed with alternating current.

LEGAL.

THE BRITISH VACUUM CLEANER CO. *v.* THE DAISY VACUUM CLEANER CO.

BEFORE Mr. Justice Neville on Friday, July 4th, MR. T. TERRELL, K.C., mentioned this patent action. He had, he said, a motion for an interlocutory injunction, but he had seen Mr. Walter, K.C., who appeared for the defendants, and had read the evidence filed on their behalf. They were agreed that it was not a case that could be decided on interlocutory proceedings, and it had been arranged, therefore, that the defendants should keep an account, and there should be no order except that the costs of the motion should be reserved.

His LORDSHIP assented.

GLYN *v.* HOLOPHANE, LTD.

(*Concluded from page* 11.)

PROF. CHAS. V. BOYS, F.R.S., further examined for the defence by MR. SHEARMAN: Does the Holophane system demand that the prisms should be a certain distance from the light, and must the light be placed a certain distance from the shade?—Yes and no, so to speak. It depends on the size of the light. If you use a small light it does not matter, but in the case of a strong light a certain distance should be maintained between the two. A small hemisphere would not be suitable for a large light.

MR. VALENTINE M. MCKINNIE, in the employ of the defendant company, explained that when the Dilux ware was purchased from the German company, in accordance with the agreement he was asked to make tests of the relative value of the Dilux and Holophane shades. He made a report to Major Glyn, pointing out the difference.

MR. SHEARMAN: Is the object of the Holophane system to throw as much light down as possible?—Yes.

And the tops and bottoms of the spheres are different?—Yes.

MR. SHEARMAN (to his Lordship) said his case was that the shades which were sold by Major Glyn at that time were inferior to Holophane, and he wanted to make it clear that Major Glyn knew that.

MR. MCKINNIE said no suggestion was made to him about grinding off the word Dilux from the shades of that name.

MR. MYGATT, in the witness-box, said his interest in the Holophane system had extended over many years, and it was not true that he had made large sums of money out of the promotion of companies in connection with the patent.

COUNSEL said there was a suggestion that the witness had bought up the assets of the company for £1,000, and Witness said the first company was started with a capital of £10,000. At the end of six years that was used up. It was proposed to get a little more capital by issuing shares, and witness took half the debentures. When the company came to an end he paid off the other debenture-holders and became liable for the debts of the company. For some time the Holophane shade was manufactured in America, and three years ago he met Major Glyn and they started the defendant company in England. Major Glyn put in £250, and witness had about £40,000 invested in the American business, which he handed over to the English company.

MR. SHEARMAN said it had been suggested that witness had neglected the interests of the defendant company, and this Mr. Mygatt emphatically denied. He said he had been ill for some time, and was not able to answer letters until September, 1911. Then he heard of the General Electric contract (by which the stock of Dilux in the hands of the G.E.C. were purchased), which had been negotiated by Major Glyn.

It has been suggested that you owe the company money, and will not pay it?—Witness replied by referring to various contracts entered into, in which assignments were made to the English company, and said he had taken the opinion of a well-known King's Counsel (now a Judge) as to his rights, and he had been advised that the company owed him nothing and he owed the company nothing. The matter had been referred to arbitration. Witness added that he heard of the Dilux contract in the summer of 1912.

Was it ever said in your presence that it was proposed to sell the stock of Dilux taken over as Holophane ware?—No.

What was your knowledge as to how Dilux compared with Holophane?—It was very inferior in every way. When he heard that Dilux was sold as Holophane he could not believe it, as he thought it impossible. He asked his informant to order a couple of the hemispheres in the ordinary course of trade to see whether it was correct that the Dilux were being sold as Holophane, and he then found that his information was correct.

Two shades were purchased, and both were found to be Dilux?—Yes.

Were they invoiced as Holophane?—Yes. Witness added that he did not hear the plaintiff say at any meeting that he had been selling Dilux as Holophane, and had been grinding off the word Dilux. The board, he said, expressed great disapproval of the plaintiff's conduct, and deprived him of his powers as managing director.

In cross-examination, Witness said that under the plaintiff's management the sales had increased, but the profits had declined of late. When the company was started he got 50,000 shares, and was also to get £25,000 in cash. He had received practically nothing of the cash.

Did you promise plaintiff, asked MR. CAMPBELL, that if he made the company a success, he would get 10 per cent. of anything that you might get out of it?—I told him that if he raised the amount of money he promised to raise and made a success of the company, I would do that which you have mentioned.

Did you charge it as fraud that Dilux ware, supplied under the agreements, was sold as Holophane?—Yes.

But that was suggested when the agreement was contemplated?—Oh, no; it was, I believe, contemplated that the stock should be broken up.

Did not the agreements contemplate that for four years Dilux ware to the value of £2,000 should be supplied, and that was to be sold as Holophane?—Witness did not agree with that interpretation of the agreement, and characterised counsel's suggestion as ridiculous.

Do you wish the jury to understand that you are charging Major Glyn with having wilfully lied to the board on December 11th?—Major Glyn stated several things to the board that were misunderstood by everybody. Major Glyn stated things to the board with the definite idea of misleading them. Witness agreed that Major Glyn was very angry when the charges were made.

LORD ERNEST HAMILTON, a director of the defendant company, also gave evidence. He said he voted for the resolution recording a lack of confidence in the plaintiff, and in doing that he decided that he was acting in the best interests of the company.

Other evidence was called to prove the sale of Dilux as Holophane, and the complaints received by the defendant company from firms in the trade.

On Tuesday, July 1st, MR. MYGATT was recalled, and asked whether he was aware of the value of the stock of Dilux at the end of 1912. He said he believed it was put down as £2,000, but he also thought the whole of the stock of Dilux was put in with Holophane stock. He strongly objected to that.

MR. SHEARMAN: There was no separate value placed on the Dilux stock?—No.

MR. E. P. BARFIELD, one of the managers of Siemens Bros. Dynamo Works, Ltd., was next called.

Have your firm, asked MR. SHEARMAN, made large purchases of Holophane shades?—Very large.

Were the spheres supplied you by Holophane of good quality in especially white glass?—Yes.

Was a conference called by the defendant company among the leading wholesale houses with regard to the sale of Holophane?—Yes. The conference dealt with the genuine Holophane material, and members of the conference were asked not to supply any cheap imitation article.

There were frequent discussions as to cheap imitations being put on the market?—Yes.

Did you know that the Dilux stock had been bought up by the Holophane Co.?—Yes.

In November of last year it came to the knowledge of the firm that there was a difference in the quality of the Holophane shades?—Yes, the spheres were very unsatisfactory and inferior.

Did complaints reach you?—Yes.

What was done with the defective spheres?—I think the majority were returned to the defendants.

Of course, the sale of inferior ware would be very prejudicial?—Oh, yes; very disastrous.

MR. CAMPBELL (cross-examining): You urged on Major Glyn the necessity of coming to some terms with the General Electric Co. regarding the sale by them of the competing Dilux shade?—Yes, and with regard to maintenance of prices.

Because you found that the General Electric Co. were competing with the Dilux ware?—Certainly.

MR. E. C. LAWTON, also an employé of Siemens Bros., Ltd., denied that he received any information to the effect that the Dilux shades were to be sold as Holophane.

MR. GEORGE LANE, A.M.I.C.E., manager of the Aylesbury Gas Co., said he was shown a sample of the Holophane shade, and was so impressed with it that he induced the managers of the Aylesbury Grammar School to purchase two 16-in. hemispheres. They were ordered from Best & Lloyd, of Birmingham, but when they came to hand, he was surprised at the difference between them and those he had seen previously. He made a complaint, and the two hemispheres were sent back. He afterwards viewed the defendant company's stock, and was handed two excellent shades in the place of the inferior ones.

That was the defendants' case, and MR. SHEARMAN said the question for the jury was whether the plaintiff had been guilty of such misconduct as would justify the defendants in dismissing him. He would argue a legal point on the articles of association of the company after the jury had given their verdict. Addressing the jury, Mr. Shearman suggested that what Major Glyn had done was done by him without the cognisance of his co-directors, and against the advice of members of the staff. He had sold inferior stuff for the real thing, thus perpetrating a fraud on the public, and that was misconduct which at once justified the defendant company in revoking his agreement, seeing that what he did was calculated to disparage the future of the company.

After MR. CAMPBELL had pointed out that Major Glyn at no time gained any pecuniary advantage from the alleged "fraud on the trade."

His LORDSHIP said Major Glyn was just as much interested in the future of the company as was Mr. Mygatt, and was, therefore not likely, *a priori*, with a set purpose, to do anything which would tend to injure the company. Major Glyn did not, it was admitted, possess technical knowledge, and in all probability he therefore *bonâ fide* believed that the Dilux and Holophane shades were to all intents and purposes similar. Was it reasonable to think that the directors, who had purchased the stock of Dilux at 50 per cent. more than its invoiced price, would throw it on the

scrap-heap without passing a resolution to that effect, and if Mr. Mygatt was not in accordance with the sale of the Dilux as Holophane, would he not have warned his co-directors of the fact that, although they paid a high price for the ware, it must be broken up so that the quality of the Holophane stock should not be depreciated? The question they had to consider was whether it was a fraud on the trade to mix up the Dilux stock with the Holophane stock and sell it—not intending to continue to do so when the Dilux had been disposed of—in the belief that one shade was as good as the other.

Without leaving the box the jury found for the plaintiff, awarding him £400 damages. His Lordship decided in the plaintiff's favour on the law, and entered judgment in accordance with the jury's findings, with costs.

Charing Cross, West End and City Electric Supply Co., Ltd., v. The London Hydraulic Power Co.

Mr. Justice Scrutton, in the King's Bench, on Saturday, July 5th, gave judgment in this case, the hearing of which was reported in our last issue.

His Lordship first dealt with the facts in regard to each burst of the defendants' water mains, and said he found that the bursts were due to subsidence of the soil above, caused by the vibration of the heavy traffic, and that the defendants' works had nothing to do with them. The pleadings alleged that the defendants' pipes were of insufficient strength, in that they were of cast-iron instead of steel, and that the joints were too rigid. He was satisfied that the cast-iron pipes and the joints were of sufficient quality, and were in accordance with first-class hydraulic engineering practice, and that while later experience might render it desirable to employ steel in some places in view of the heavier traffic now using the City, he was satisfied it was not negligent to use the pipes and joints now used. He thought the bursting of the pipes did throw on the defendants the burden of accounting for it, and that unexplained the bursts were evidence of negligence. The defendants satisfied him that the pipes which burst were sound pipes of sufficient strength, and that the bursting was due to subsidence of the soil which defendants did not cause, and which they could not by reasonable care detect. They kept watch on their pipes. They looked out for leakage, and watched the surface for subsidence. But they could not be continually pulling up the streets of the City of London to see that all was going on allright underneath. The remedy or precaution would be worse than the accidents which might happen. He, therefore, found that the defendants were not guilty of any negligence in the construction of their system, or in its working. On this finding defendants contended that they were under no liability, and that before plaintiffs could succeed they must establish negligence. All four works were executed in the statutory zone authorised by the Act of 1871, to which plaintiffs replied that while this was so, two of them were executed after the defendants' second Act of 1884 was obtained, and that though the first Act did not contain the usual section, "Nothing in this Act shall exempt the company from any indictment, suit, action or proceeding in respect of any nuisance caused by them," the Act of 1884 did contain the section. It also contained a section saying that the Act of 1871 was to be read together with that of 1884. Plaintiffs contended that the effect of these clauses was that Sec. 17 of the Act of 1884 applied to all works executed under the Act of 1871. He held that contention to be correct. The result was that the defendants had not an absolute statutory authority to lay their mains, but a power qualified by the provision that granting them the power was not to affect their legal liability and nuisance. Without the guidance of cases that had been cited, he must have given the matter more careful consideration, as it was not clear at first sight that the isolated damage not caused by defendants was a nuisance. The cases cited bound him to decide that the defendants had brought for their own profit a dangerous thing—water at a very high pressure—so that if it escaped, it did enormous damage. They were liable for escapes, even without their negligence, unless they could bring themselves within the one exception to the doctrine of absolute liability which they had not established. All the exceptions to the statutory authority which would be a defence were excluded under the terms of Sec. 17 of the Act of 1884. The gradual subsidence of the soil by wear and tear of traffic was not an act of God, which would be an exception. He had found that the subsidence did not result from the Act or default of the defendants, not did it result from the action of a third party which defendants were not under any duty to guard against, which would be a defence. But for Midwood's case (a case cited), he should have some doubt whether defendants were not affected as persons using the road in the ordinary way, and not liable for damage caused by the user unless negligence was proved. But he thought it was now an ordinary user of the road to carry mains of water, gas and electricity underneath it, and there was something to be said for the view that all these co-licensees take the road subject to the risk arising from the ordinary use of their co-users. In the result, he thought the defendants had brought a dangerous thing into the road, and the dangerous thing had escaped through the subsidence of the soil. That was just how the water escaped in Rylands and Fletcher (a cited case), where defendants were held liable. In his view, he was bound to hold the defendants in this case also liable. He, therefore, held that defendants were liable for the amount claimed, with costs. The same measure of justice would also apply to the plaintiffs as to their escapes and any damage caused.

Cork Tramway Claim.

At Cork City Quarter Sessions on June 30th, Hannah Carroll sued the Cork Electric Tramways and Lighting Co., Ltd., for £20, for loss and damage sustained through the negligence of the defendant company's servants in replacing flags on the footpath in Albert Street, Cork.

Plaintiff's case was that on April 22nd last, she was walking along the footway opposite the Cork, Blackrock and Passage Railway station, and owing to the negligent way in which the servants of the defendant company had relaid the flagging of the footpath there, she was suddenly tripped up and fell. As a result of that fall, she had been prematurely confined, and her child since birth had been suffering from injury to the spine, and was being treated for it. The defence was a denial of negligence. The flags in question had not been permanently replaced at the time, as it would have been bad workmanship to have them replaced before the ground had become consolidated. There was plenty of light at the place, and a watchman had been employed at the spot complained of by plaintiff.

The Recorder granted a decree for £6 against the company.

Infringement of Colliery Rules.

At Lanchester Police Court on the 3rd inst., Thomas Gardiner, a workman in charge of an electrical coal-cutting machine at Hamsterley colliery, near Ebchester, pleaded guilty to a charge of having infringed the special rules of the colliery. For the prosecution, it was stated that the accused had doubled the fuse in the machine. Accused was fined 20s. and costs.

H.M. Postmaster-General v. The Hendon Urban District Council.

In the Railway and Canal Commission Court, before Mr. Justice Bankes, the Hon. A. E. Gathorne Hardy and Sir James Woodhouse, on Monday, July 7th, this case was heard.

The Solicitor-General (Sir J. Simon) appeared for the Postmaster-General, and explained that the matter came before the Commissioners under the provisions of the Telegraph Acts. The Acts provided that "any body or persons within the meaning of the 1863 Act, having power to give or withdraw their consent to the Postmaster-General to place telegraph poles in or along a street or public road, and failing to do so within 21 days after request has been made by the Postmaster-General, a difference shall be deemed to have arisen between the Postmaster-General and such body or persons, and that difference shall be decided by a stipendiary magistrate, or, failing such magistrate, by a County Court Judge." It was further provided that should the parties be dissatisfied with the award, the matter might be brought before the Railway and Canal Commission Court. Such a position had arisen between the Postmaster-General and the Hendon authority in respect of the telegraph poles within the Council's area. The Postmaster-General contended that the Hendon U.D.C. was a body within the Acts which had power to give or withhold its consent, and the other side submitted that owing to the facts and circumstances about the particular roads in question, the Hendon U.D.C. had nothing to do with the matter. There was another point, as to whether the three roads affected were streets or public roads within the meaning of the statute.

Mr. Foote, K.C., for the urban authority, said he did not propose to contest that point. The only point was whether the Hendon authority was a body entitled to give or withdraw its consent.

Sir J. Simon submitted in the course of his arguments that the decision of the County Court Judge, to the effect that the Hendon Council was not a "body" within the meaning of the statute, was wrong. What happened, as had happened in this case, was that in outlying but developing districts, houses were built, large houses, and the telephone system naturally extended its feelers into such districts. A man would build his house and want the telephone. It then remained for the Postmaster-General to bring the wire to his house. The way to do that was to ask the proper authority or person for leave to go down that road. It was purely a question in this case whether the Postmaster-General had asked the right authority, but the seriousness of the matter was that if he had not there was no one else to go to as a person or body who, within the meaning of the Act, had control over the roads in question. It was argued for the Hendon Council that that authority was not responsible for the repairs of the roads in question, but that, Sir John argued, did not prove that that body was not the controlling authority.

Mr. Foote, K.C., for the urban authority, contended that his clients had not control over the roads in question such as would bring them within the provisions of the Telegraph Acts. It was quite true if the owners of a road failed to make it up to the satisfaction of the Urban Authority, the Council might call upon such owners to repair to its satisfaction, but he submitted that that did not give the Council such a control over the road as would empower it to grant to or withhold permission from the Postmaster-General to erect a telephone system down that road.

The Commissioners intimated that they would consider their judgment, and deliver it at a later date.

NATIONAL TELEPHONE CO.—DISTRIBUTION OF ASSETS.

IN the Chancery Division on Tuesday, Mr. Justice Neville heard an application in the above matter.

Counsel said there was a summons in the list by the liquidator as to the distribution of the assets. The summons was partly heard by Mr. Justice Swinfen Eady, and it was important that the matter should be disposed of before the long vacation. Mr. Justice Astbury (the other company judge) had advised on the matter when practising at the bar, but the state of Mr. Justice Sargant's list was such that he thought that judge would be able to take it.

His LORDSHIP: How long will the case last?

Counsel said he thought about a day.

His LORDSHIP said he would consult Mr. Justice Sargant about the matter.

JOHNSON-BILLINGTON ELECTRICITY METERS, LTD.

IN the Company's Court on Tuesday, Mr. Justice Neville had before him the petition of W. H. Johnson for the compulsory winding-up of the above company. Counsel, who appeared in support of the petition, asked that it should be dismissed without costs. The petitioner was the only creditor of the company. His Lordship dismissed the petition without costs.

LITHOLITE, LTD. *v.* TRAVIS AND INSULATORS, LTD.

IN the Chancery Division, on 4th inst., Mr. Justice Joyce heard this action for an injunction restraining the first defendant from disclosing particulars of the plaintiffs' secret process for making litholite and restraining Insulators, Ltd., from employing Travis in breach of the terms of an agreement entered into by the latter with Litholite, Ltd.

Evidence having been called, his Lordship (according to the *Financial Times*) granted an injunction against both defendants.

BRITISH INSULATED & HELSBY CABLES, LTD., *v.* THE LONDON ELECTRIC WIRE CO. AND SMITH'S, LTD.

AT the Chancery Court of Lancashire, held at Liverpool on Monday, Vice-Chancellor Stewart Smith, K.C., delivered judgment in this action, which was reported last week. He gave judgment for the defendants, with costs. We shall probably quote from the judgment in our next issue.

THE POULSEN TELEGRAPHONE PATENT.

IN the Chancery Division on July 3rd, Mr. Colefax, K.C., on behalf of the petitioner, Valdemar Poulsen, applied to Mr. Justice Warrington to allow the evidence of M. Poulsen and another witness from Denmark to be given in support of the petition to extend the time for the patent No. 8,961 of 1899, granted to M. Poulsen, to be taken before a special examiner. Counsel said these witnesses, who were in this country to give their evidence in the petition put down for hearing that day by his Lordship, had to return to Denmark before the petition could be heard.

The SOLICITOR-GENERAL, K.C., said he appeared for the Crown, and did not oppose the application, but the Crown must not be held to blame if all the evidence his Lordship desired was not brought out before the Examiner.

His LORDSHIP: You can recall them.

His Lordship granted the application, and on a further application by counsel, appointed Tuesday last for the hearing of the petition.

On that day MR. COLEFAX, in opening for the petitioning company (the Telegraphone Corporation of Columbia, U.S.A.), explained that the patent was for an apparatus for storing up speech or signals by magnetically influencing magnetisable bodies or wires. It was an invention of striking novelty and note, and he would call expert evidence to say that until the apparatus was seen working it was not thought possible that the terms of the specification could be carried out. The invention was based on the fact that when a body made of a magnetisable material was touched at different points and at different times by an electromagnet included in a telephonic or telegraphic circuit, its parts became subject to such varied magnetic influences that conversely by the action of the magnetisable body upon the electromagnet, the same sounds and signs were subsequently given out in the telephone or recording instrument as those which previously caused the magnetic action on the magnetisable body. Pulling it simply by means of a wire or band of metal becoming magnetised by means of a current set up when an ordinary telephone was spoken into, it was possible to faithfully reproduce inflexions of the human voice upon the steel band or wire with extraordinary clearness. The invention was of the greatest importance to the telephonic transmission of speech, because by the device used in conjunction with a telephone, it was possible to take communications transmitted in the absence of the subscriber for whom they were intended, to be given out again in faithful reproduction wherever required. Briefly put, it was a method of receiving, storing and reproducing messages, signals, or the like, by subjecting a magnetisable body, such as a steel wire or strip, to the action of an electromagnet which moved along it, or along which it was moved, the coil of the magnet being first in connection with the transmitter, so that the wire or strip was influenced in a manner corresponding to the signal transmitted, the coil being then in connection with the telephone receiver, by which the signals which influenced the wire or strip were reproduced. From a commercial standpoint, continued counsel, the greatest future of the machine was as a dictating machine, and it had been perfected by the long labours of Danish and American companies. The machine, as originally constructed, was composed chiefly of a horizontal cylinder or band which reproduced, with extraordinary clearness, the human voice, but it had one or two serious drawbacks, one was that the electromagnet travelled over it in about half a minute, which, of course, rendered the apparatus useless as a dictating machine. Then there was an improved pattern brought out in which the cylinder was superseded by a piano wire coiled round drums. The wire travelled from one drum to another, and was of considerable length, and would run for some 30 minutes. When the record of the conversation and dictation was taken, the drums or spools of wire could readily be tranferred to another machine, and the conversation or whatever it might be clearly reproduced. There were other improvements, and the result of it all was that the human voice was reproduced without that nasal twang and distortion which was the difficulty with the ordinary gramophone and disk machines.

MR. JUSTICE WARRINGTON said the British patent had already expired; he did not know whether any difficulty arose with regard to that.

The SOLICITOR-GENERAL said he did not intend to raise any ground of objection with regard to that.

(To be continued.)

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The "Disc" Moving-Coil Instruments.

The accompanying illustration shows a moving-coil instrument of the long-scale type, suitable for use on a D.C. switchboard, which MESSRS. EVERETT, EDGCUMBE & CO., LTD., of 117, Victoria Street, S.W., have recently introduced. These instruments are similar in appearance to the same firm's long-scale instruments for A.C. circuits, in which the scale occupies practically the whole of the circumference. The scale is exceptionally long considering the size of the instrument, and is extremely easy to read even from a considerable distance. The "Disc" type moving-coil ammeters and voltmeters have evenly divided scales and are magnetically shielded; temperature errors are quite negligible. They are also extremely dead-beat in action. A full scale deflection is obtained with 0·075 volt across the shunt terminals up to and including 3,000 amperes. Above this current the volt drop is special. The voltmeters are directly connected, in general through an external resistance box, up to 800 volts.

FIG. 1.—"DISC" TYPE D.C. MOVING-COIL AMMETER.

The standard finish is a bright black stove enamelled cast-iron case with the facings in relief of polished nickel or copper. They can be supplied of the projecting pattern for mounting direct on the board, and of the flush pattern to be let into the board. They can also be supplied of the controller pattern with a flanged base for use with ironclad gear. The overall diameter of the projecting pattern is 9⅞ in.

E

Mirrlees Condensing Plant for the Glasgow Tramways.

In connection with the 5,000-KW. turbo-alternator which has recently been installed by the Glasgow tramways department, the condensing equipment, as in the case of the previous seven sets, was supplied by the MIRRLEES WATSON CO., of Scotland Street, Glasgow.

The condensing plant is of the surface type, with a single turbine-driven pump set for air and water extraction, and circulating purposes, and is designed to deal with 72,000 lb. of steam per hour, giving a 28-in. vacuum with cooling water at 70° F. The condenser

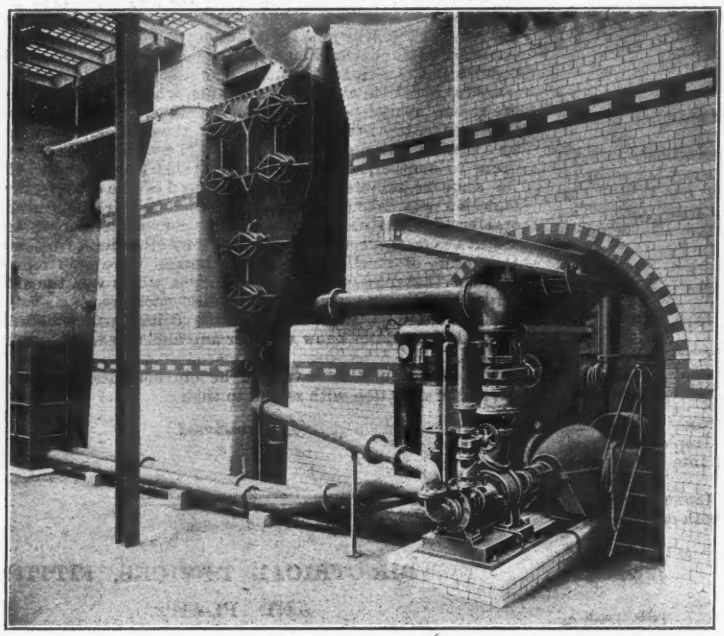


FIG. 2.—CONDENSER WITH TURBINE-DRIVEN MIRRLEES-LEBLANC ROTARY AIR PUMP AND CENTRIFUGAL CIRCULATING PUMP FOR 5,000-KW. TURBINE.

is wedge shaped, with 10,200 sq. ft. of cooling surface, and the internal tubing is arranged so that the circulating water passes from end to end three times before being discharged.

The air and water extraction pumps are of the Mirrlees-Leblanc rotary pattern, mounted on the same spindle as the centrifugal circulating pump, and direct driven at 2,000 R.P.M. by a 120-B.H.P. Curtis steam turbine. The water extraction pump delivers to a Lea Recorder placed 20 ft. above the floor. The circulating pump delivers 6,000 gallons per minute against a total head of 20 ft.; it is fitted with six small diameter impellers working in parallel and

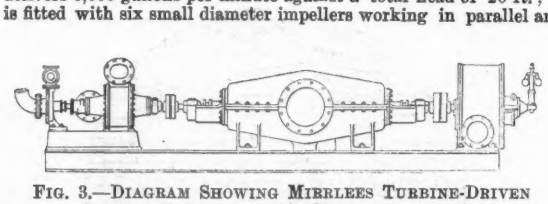


FIG. 3.—DIAGRAM SHOWING MIRRLEES TURBINE-DRIVEN PUMP SET, CONSISTING OF (LEFT TO RIGHT) CONDENSATE, AIR AND CIRCULATING PUMPS AND TURBINE.

has an efficiency of 62 per cent. Our illustrations, figs. 2 and 3, show the extremely compact design of the pumping set, which, we understand, is practically noiseless in working.

From readings taken under usual working conditions, when the steam per hour dealt with increased gradually from 64,000 lb. to 90,000 lb., the vacuum in the turbine exhaust chamber dropped gradually from 28·6 in. to 28 in., the circulating water inlet and outlet temperatures being 54° F. and 80° F. for the lower duty, and 63° F. and 89° F. for the higher duty, and the temperature difference between inlet steam and circulating water outlet being 4° F. at approximately the rated duty of the condenser.

St. Germans.—WORKHOUSE LIGHTING.—The B. of G. has appointed a Committee to consider a more modern method of lighting the workhouse premises, oil being the present illuminant, together with the advisability of installing a telephone system. Some three years ago the board decided in favour of the electric light, but the proposal was never carried out. There is now a prospect of electricity being introduced into Torpoint, in which event the supply will be available for the workhouse.

BUSINESS NOTES.

Book Notices.—We have received from MESSRS. CREED, BILLE & CO., LTD., of Telegraph Works, Selsdon Road, Croydon, a handsome brochure describing the Creed system of high-speed automatic printing telegraphy, which is in use in the offices of six British and foreign Governments and four leading submarine telegraph companies. In this system the keyboard is an essential component; the keyboard perforator works at 60 words per minute; the receiving perforator can reproduce Wheatstone perforated slip at 200 words per minute, and the printer, controlled by the perforated tape, turns out the message in large capitals at a speed of 775 letters, or 155 words, per minute. The system can be readily adapted to work in conjunction with existing systems without a specially trained staff, and greatly increases the capacity of the lines, besides saving all manual retransmission and copying. The British Post Office employs it at several of its chief offices, and it is working on a number of submarine cables up to 500 miles in length, as well as on landlines 2,000 and 3,000 miles long; excellent reports from the users are reproduced, one in particular from Lord Northcliffe referring in almost enthusiastic terms to the efficiency with which the Creed machines transmit the entire contents of the *Daily Mail* to Manchester, saving time and labour and preventing errors. Descriptions of the apparatus are given, largely reprinted from our pages, and an account of the *Daily Mail* installation is included. The style of the brochure deserves special mention, the paper, printing and illustrations being of the highest order.

"Science Abstracts." Vol. XVI, Part 6. June 30th, 1913. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"Experimental Wireless Stations." By Philip E. Edelman. Minneapolis: The Author. Price $2.

"Graphs in a Cable-Ship Drum-Room. Notes for Junior Assistants." By E. Raymond-Barker. London: H. Alabaster, Gatehouse & Co. Price 2s. 6d. net.

"*Journal* of the Western Society of Engineers." Vol. XVIII, No. 5, May, 1913. Chicago: The Society. Price 50 cents.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXII, No. 7, July, 1913. New York: The Institute. Price $1.00.

"*Bulletin* Mensuel of the Société Belge d'Electriciens, Vol. XXX, May, 1913. Brussels: E. Bruylant. Price 1 fr. 75 c.

"*Bulletin* of the Association des Ingenieurs Electriciens." Vol. XIII, May, 1913. Liége: The Association. Price 13 fr. 50 c.

"*Bulletin* de la Société Internationale des Electriciens." Vol. III, No. 25, May, 1913. Paris: Gauthier-Villars. Price 2 fr. 50 c.

"Annales des Postes, Télégraphes et Téléphones." June, 1913. Paris: A. Dumas. Price 6 fr.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII, No. 12, June, 1913. Milan: Stucchi, Ceretti & Co. Price L 1.50.

Mr. Ferdinando Geronimi, of Piazza Venezia 2, Milan, informs us that arrangements have been made with the Committee of the Congress which enable him to offer his "Chronique Illustrée du Concours International de Télégraphie Pratique" at the low price of 10 francs, post free.

Patent Applications.—Application has been made by Edward Temple for restoration of Patent No. 25,736, of 1908, for "Improvements in and relating to washing or purifying apparatus for use in gas generating plants."

Mr. Justice Warrington, in the Chancery Division, will, on October 27th, hear the petition of the NATIONAL TELEWRITER CO., LTD., for an extension of the term of patent No. 24,048 of 1899 (granted to Foster Ritchie), for "Improvements in telautograph apparatus."

Catalogues and Lists.—MESSRS. SIEMENS BROS. AND CO., LTD., Woolwich, Kent.—Illustrated leaflet (No. 534 I) describing the Siemens watertight loud-speaking marine type telephones.

MESSRS. EVERETT, EDGCUMBE & CO., LTD., 117, Victoria Street, Westminster, S.W.—Catalogue sheet (10A) describing a new type of moving coil long-scale instruments suitable for use on continuous-current switchboards.

MESSRS. A. P. LUNDBERG & SONS, 477 to 489, Liverpool Road, London, N.—Two new circulars, "H" and S35. The former which is a second and enlarged edition of 16 pages, relates to tumbler switches for the control of heating and cooking appliances, a large number of controls being shown. The latter is a four-page list of the "Imp" single and two-way switches.

THE SANITAS ELECTRICAL CO., LTD., 61, New Cavendish Street, London, W.—A batch of fully-illustrated lists giving brief particulars and prices of their electric vibrators and hot and cold air apparatus, also a large sheet of illustrations of the numerous electro-medical instruments and outfits supplied by the firm.

MESSRS. WERTHS & CO., 41, Aldersgate Street, London, E.C.—Lists relating to and giving prices of their non-rubber compound for insulating and filling in cable ends, sleeves, &c.; also "Elektraband" insulating tape, both of which they are introducing. Certificates of tests of the compound, made at the Physical-Technical Imperial Institute at Charlottenburg, accompany the lists.

MESSRS. ERITH'S ENGINEERING CO., LTD., 70, Gracechurch Street, London, E.C.—No 213 catalogue (second edition) of 20 pages fully describes and illustrates with both half-tone and sectional views, their patent recording heater, purifier and filter.

THE WESTINGHOUSE COOPER-HEWITT CO., LTD., 80, York Road, King's Cross, London, N.—List No. 24 contains illustrated descriptive matter relating to Cooper-Hewitt mercury vapour converters for projection arcs, with notes on their advantages, installation, bulb replacement, and tabulated prices, on single and three-phase supplies, 40-60 periods. These converters have been largely adopted for use in cinematograph theatres on A.C. supply, providing the advantage of low-voltage D.C. for the arc with the economy of regulation possible with A.C.

THE EDISON AND SWAN UNITED ELECTRIC LIGHT CO., LTD., Ponder's End, Middlesex.—Specimens have been received of electric fan postcards that are being issued to the trade. The supply is limited, but we understand that the company will send a number to any of their fan customers who have not already received same.

MESSRS. VERITYS, LTD., 28, King Street, Covent Garden, London, W.C.—24-page export list (No. 724) of Aston tropical fans—desk, ceiling, railway carriage, saloon, ships' cabin, portable, electrolier and other types, also the "Aston-Sirocco" D.C. pressure blowers. Fan speed regulators are also shown and priced.

MESSRS. SIEMENS BROS. DYNAMO WORKS LTD., Tyssen Street, Dalston, London, N.E.—Price list D10 (20 pages) contains full particulars, illustrations, and prices of weatherproof lanterns, (including new designs of internal fittings, with white enamelled zinc reflectors, for gas lantern conversion) and street lighting fittings (brackets, lamp-posts, &c.) for "Wotan" and tantalum lamps. Among the devices illustrated is the new Goliath Edison screw-holder for use in connection with high C.P. lamps burning in series. This is fitted with a special shunting device which immediately completes the circuit in case of a lamp failure and also when the lamp is withdrawn from the holder. Copies of the list will be sent to illuminating and other engineers interested in street lighting schemes.

Dissolutions and Liquidations.—G. C. MILNES, VOSS & CO., LTD.—This company is winding up voluntarily with Mr. H. R. Graves, 51, North John Street, Liverpool, as liquidator. A meeting of creditors is called for July 18th.

ANGLO-NORWEGIAN ALUMINIUM CO., LTD.—This company is winding up voluntarily with Mr. F. C. Potter, 28, Victoria Street, S.W., as liquidator. A meeting of creditors is called for July 18th.

INTERNATIONAL "Z" LAMP ASSOCIATION, LTD.—A meeting will be held on August 11th, at 22-28, Broad Street Avenue, E.C., to hear an account of the winding up from the liquidator, Mr. C. Field.

H. F. ANGUS & CO., manufacturers of and dealers in scientific instruments, 83, Wigmore Street, Cavendish Square, London.—Messrs. M. J. Swift & H. F. Angus have dissolved partnership. Debts will be attended to by Mr. Angus who will continue the business under the same style.

LIVERPOOL FITTINGS CO., electrical fittings and accessories dealers, 55, Renshaw Street, Liverpool.—Messrs. E. J. Arnold and I. E. Poyser have dissolved partnership. Mr. Poyser attends to debts, &c., and will continue the business under the same style.

DONCASTER ELECTRICAL CO., LTD.—Creditors must send particulars of their debts, &c., to Mr. A. E. Stringer, Manor Row Chambers, Bradford, one of the liquidators, by July 21st.

THE ELECTRICAL AND INCANDESCENT STORES, Manchester Chambers, Parliament Street, Nottingham.—Messrs. G. Moore and J. T. Kemp have dissolved partnership. Mr. Kemp will attend to debts and continue the business under the old style.

Bankruptcy Proceedings.—FRANK HUCKS, electrical engineer, 2, Adelaide Road, Hampstead.—The public examination was held on June 3rd, at the London Bankruptcy Court, before Mr. Registrar Hood. The receiving order was made on June 4th last, on the application of the debtor, who returns unsecured liabilities £777, and assets, good book debts, £111, and a bad debt of £90. Replying to Mr. W. P. Bowyer, Official Receiver, the debtor stated that, having previously been employed in the trade, he, in October, 1908, commenced business as an electrical engineer and contractor at his father's office in James Street, Camden Town, removing in May, 1910, to 18, Charing Cross Road, W.C. From February, 1911, till last February he carried on the business from Adelaide Road. In May he formed a company to conduct aerial flights, and had since been employed by the company. Witness attributed his insolvency to loss on contracts owing to their having been underestimated, and to ill-health. The examination was concluded.

Trade Announcements.—MESSRS. WM. WHITE & CO., of 25, Budge Row, E.C., announce a change in their telephone numbers to:—City 689 (three lines).

MESSRS. SCHOLEY & CO., LTD., announce that their telephone number has been altered to "City 5863" (two lines).

MESSRS. SCARR, dealers in electric light fittings, have opened new premises at New York Street and Kirkgate, Leeds.

THE "BALDUR" ENGINEERING AND SUPPLY CO., LTD., 39, Victoria Street, S.W., have been appointed sole agents for London by the Stella Conduit Co., of Bilston. They have taken additional stores for the purpose of carrying a complete stock of conduits and conduit fittings for immediate delivery. They will forward lists of cables and electrical accessories on application.

MESSRS. MORRIS & LISTER (LONDON), LTD., 3 and 4, Palace Chambers, Bridge Street, Westminster, S.W. (directors, Mr. D. K. Morris, Ph.D., M.I.E.E., Mr. F. J. Bakewell, A.M.I.M.E.; manager, Mr. Philipp Laubach, A.M.I.E.E.), have now taken over the whole selling organisation of Messrs. Morris & Lister, Ltd., Coventry, and are developing further agencies for the sale of electrical apparatus of all descriptions. All inquiries, &c., should be addressed to Messrs. Morris & Lister (London), Ltd., instead of to Messrs. Frampton & Paine, as formerly.

Mr. Lester B. Betts, who has for some years been associated with the electrical export trade, has started business as a manufacturers' agent and general wholesale and export supplier, at 9, London Street, E.C., under the style of LESTER B. BETTS & CO., LTD., and has the agencies for several important English and Continental manufacturers.

LIGHTING and POWER NOTES.

Accrington.—The borough electrical engineer has reported that the sulphate of ammonia plant in connection with the gas engines at the electricity works is now in working order again, and that the sulphate on analysis is quite satisfactory. He has also reported that the Accrington Brick and Tile Co. has put to work a 220-H.P. motor, the largest individual motor on the plant.

Barrow.—According to a report by the borough treasurer, the gross profit on the electricity department for the past year was £8,274, and the net profit £702.

The Council has decided against reconsidering the lighting of the main streets of the borough, although a claim was made for high pressure incandescent gas lights rather than the present electric lights.

Belfast.—NEW LOAN.—The T.C. has decided to apply for sanction to a loan of £35,000 for mains, services and meters, in connection with the electricity undertaking.

Blackburn.—The abstract of accounts for the year ended March 25th last shows that the income of the electricity undertaking was £42,460, and the expenditure £36,916, leaving a profit for the year of £5,544. In the provision for the redemption of debt there is set aside £11,161.

Bootle.—ANNUAL REPORT.—Mr. T. D. Clothier, the borough electrical engineer, in his report, states that the trading of the undertaking has resulted in a surplus revenue which has been sufficient to pay interest on the capital employed, the sum required to repay the capital within 25 years, £200 into the machinery insurance account, £1,500 as a contribution in aid of the general district rate, and £860 as a contribution to the contingency fund. The surplus shows an increase over that realised last year, and exceeds the amount which was estimated by £439. The undertaking is now in a position to supply large consumers, and to give a bulk supply wherever this is required. The new generating station is nearing completion, and will be used in conjunction with the Pine Grove Station during the latter part of the ensuing year. The need for laying a second H.T. feeder, and providing a substation, has necessitated the immediate provision of this plant. The Committee has not seen its way to revise the rates of charging until after beneficial use of the new works has been obtained, more especially in view of the heavy increase in the price of coal.

Bournemouth.—PUBLIC LIGHTING.—The T.C. has decided to apply to the L.G.B. for a loan to carry out schemes of electric lighting at the Undercliff Drive and the West Undercliff Promenade. Arc lamps of 2,000 C.P. each are to be utilised; current will be supplied by the Bournemouth and Poole Electricity Supply Co., Ltd.

Bradford.—The system of supply in the Leeds Road district east of Lapage Street is to be changed from direct to alternating current. The cost of providing new cables and relaying cables is put at £1,500.

Burnley.—ANNUAL REPORT.—The report of Mr. J. E. Starkie for the year ended March 31st last, shows that the total capital expenditure was £132,961, against £126,895 the previous year. The total net income from all sources amounted to £29,751, against £26,940 for the previous year, an increase of £2,810. The increased income of £2,810, after deducting £848 increased costs, represents £1,962 more profit on revenue account than in the previous year, the gross profit this year being £15,998, against £14,036. The net profit is £7,926, against £6,781 in the previous year. The balance of reserve and depreciation fund now stands at £23,038, which represents 17·3 per cent. on the total capital expenditure, or 28·8 per cent. of the amount still owing on mortgage loans. The capacity of the plant now stands at 3,890 KW. The amount contributed towards the relief of the rates is £4,500. The total units sold were over 4½ millions, an increase of 535,000 on the previous year. Mr. Starkie recommends that a new booster and automatic regulator be obtained to deal with peak loads on traction, and thus obviate the necessity of running small sets for short periods. The cost of the above plant is estimated at £550, but the engineer states that there is no doubt as to its being a very remunerative investment.

Cardiff.—PROPOSED LOAN.—It is stated that the Corporation has been asked to raise a loan of £30,000 for the provision of new plant at the power station.

Carlisle.—There was a gross profit of £8,736, and a net profit of £1,509 on the working of the electricity undertaking during the past year. The net profit for the previous year was £3,340.

Continental Notes.—Austria.—The Erste Brunner Maschinenfabrik Gesellschaft, of Brunn, reports an increasing demand for steam turbines. Last year such plant to the extent of 71,000 H.P. was turned out, while among the orders at present in hand are five with a capacity of over 40,000 H.P. for the new central electric lighting stations of the Vienna municipality. The company has also lately taken up the construction of Diesel engines.

Italy.—A company has lately been formed at Bivongi with the title La Societa Idro Elettrica L'Avvenuire to establish a plant to utilise certain available water power near that town in the generation of electrical energy for lighting and power purposes.

France.—A new departure in electric lighting schemes is being made in the Marne department of France, where the authorities of no less than 52 communes have formed an Inter-Communal Commission with the view of drawing up a scheme to establish a central generating station for the supply of electrical energy for lighting and power purposes throughout the district.

Croydon.—The Guardians have adjourned the consideration of the question of wiring the Crosslands and Linden Homes, in order to enable the clerk to submit a return of gas, &c., used at these homes during the past year and the cost of electric lighting, &c., at the Pawson's Road Homes.

Darwen.—Loan Sanction.—Sanction for the borrowing of £3,572 for mains, £1,050 for extension to boiler house, and £1,778 for new boiler, &c., and transformers, has now been received from the L.G.B.

Durham.—Colliery Electrification.—The Londonderry Collieries, Ltd., has decided on an extensive scheme of electrification at its Seaham and Silksworth Collieries, under the direction, and to the specification of Mr. W. C. Mountain, of Newcastle-on-Tyne, the consulting engineer to the company. At the Seaham Colliery a 750-KW. mixed-pressure turbo-generator is being installed, as also a 160-H.P. electrically-driven three-throw pump for main shaft pumping purposes. Two new haulage gears with motors of 500 H.P. are also being put down to replace the old steam-operated gear, the boilers in connection with which underground are being removed. At the Silksworth Colliery two 750-KW. turbo-generators, arranged to be operated by the exhaust steam from the winding engine plant, are being laid down, together with three electrically-operated haulage gears.

Ebbw Vale.—A serious explosion occurred on Wednesday, last week, at the Ebbw Vale blast furnaces, which is reported to have completely wrecked the boiler house and "electric lighting" house.

Egglescliffe.—The P.C. is considering with the Preston P.C. an offer by the Cleveland and South Durham Power Co. to introduce the electric light into the parish. Providing there is a sufficient demand, the company will supply current at 4½d. per unit.

Elland (Yorks.).—A Sub-Committee of the Street Lighting Committee of the District Council has recommended that all the arc lamps be converted into high C.P. street lighting lanterns. The recommendation has been adopted, and tenders are to be invited for the supply of lanterns.

Farnworth.—The Electricity Committee has amended the lighting charges as follows:—That power consumers of 2,000 units and over per quarter be allowed 10 per cent. of the annual consumption for lighting and other purposes; current for lighting in excess of this quantity to be charged at lighting rates.

Foleshill.—The D.C. has received intimation of the intention of the Midland Electric Light and Supply Co. to apply to the B. of T. for a prov. order to give a supply to various portions of Warwickshire, including Bedworth, Binley, Walsgrave, and Willenhall.

Glasgow.—Although it will be some time yet before the annual report of the T.C.'s electricity department is issued, the Glasgow correspondent of the Review learns on good authority that something in the nature of a record has been accomplished in the 12 months ending May 31st. It is stated that the output works out at about 50 per cent. above that for 1911-12. This is attributed in great measure to the many power consumers now supplied from the Corporation mains, quite a number of steam plants in large works having been displaced by electrical installations recently. A no inconsiderable fillip has also been given by the growing popularity of electricity for heating, cooking and other domestic purposes, apart from lighting. In this respect, however, the electricity department labours at a disadvantage compared with the gas undertaking, under whose auspices cookers are given out free, while gas fires are supplied on the hire-purchase system. The electricity department has not even a showroom and cannot, or has not the T.C. sanction to supply appliances direct to the consumer. It is understood too—the high prevalent prices of coal notwithstanding—that the balance-sheet is a most satisfactory one. Definite figures are not yet available.

Grasmere.—A postcard canvass is being made by the Windermere and District Electric Lighting Co., in order to ascertain whether it will be worth while to extend the cables to the parish.

Hamilton.—Plant Extensions.—Plans passed the Dean of Guild Court last week, for an extension costing between £9,000 and £10,000 at the electricity works of Messrs. Edmundson's Corporation, Ltd. A new high-speed engine and dynamo of 400 KW. capacity and new condensing plant for 1,000 KW., together with Babcock boilers, will be added.

Hastings.—At Friday's meeting of the T.C., the chairman of the Electricity Committee, in reply to questions, said the present charge of 6½d. per unit to private consumers came into force on July 1st, 1909; since that date the prices for current for heating and power had been reduced from 3d. to 1½d. per unit, and the cost per unit calculated upon current sold was '98 of a penny. A proposal of the Electrical Committee to reduce the price of current for heating and power to 1d. per unit and reduce the rental of meters was rejected, and the Committee was directed to consider the advisability of reducing the cost to private consumers.

King's Lynn.—Annual Accounts.—The annual statement of accounts shows a profit of £876 on the past year's working of the electricity department, as compared with £503 in the previous year, despite the fact that the rise in the price of coal had caused increased expenditure and the rates were £94 more. From the year's profit the Committee decided to pay off the past year's capital expenditure on mains, meters, &c., amounting to £246. This would leave £629, which would bring up the balance in the reserve fund to £2,140, which will be used for the extensions of plant and buildings recently decided on.

Leeds.—The City Council has adopted the recommendation of the Electricity Committee for supplying electricity to Bramley, and has authorised the construction of two transformer chambers at Bramley, the engineer (Mr. C. N. Hefford) to lay mains at a total estimated cost of £10,200. The British Westinghouse Co. has been instructed to supply five 325-KW. 50-period rotary converters for Bramley and Kirkstall stations at total cost of £3,885. A spare main from Copley Hill to Bramley is to be placed at the service of the department.

London.—Hackney.—In consequence of the rise in prices, and the ultimate selection of the sub-station sites, the Electricity Committee of the B.C. recommends the adoption of a supplemental estimate of £3,250, which represents the extra cost of the conduits and mains work required to be done in connection with the scheme for extending the transmission and feeding systems.

Hammersmith.—*Proposed Hydraulic Coal Storage and Conveying Plant.*—The E.L. Committee is recommending to the Council, in principle, a novel scheme for coal storage and conveying in connection with the electricity works, which has been outlined by Mr. Bell, the borough electrical engineer. The cost of delivering coal over the Corporation wharf to the electricity works, at present works out at 5·85d. per ton, but as additional coal is handled over a private wharf, the cost actually averages 7·02d. per ton. In order to safeguard the fuel supply at the station and prevent deterioration, Mr. Bell proposes to store the coal there under water in tanks, five of which are suggested. His complete scheme appears to be to lift the coal from the barge by a Priestman Grab, dropping it into an automatic weigher, from which it would pass into a hopper, and from the latter be automatically fed into a suction tank by a centrifugal suction dredger pump; the tank would also be fed with water from the station circulating mains or from the return pipe from the coaling tanks. The dredger pump would deliver a mixture of coal and water to a pipe line (15 per cent. of the volume being coal), the velocity in the pipe being 7 ft. per second. The pipe would deliver to an auxiliary coaling tank, which it is suggested shall hold a barge load of coal, near the station, and if it were decided to transfer the coal to a main storage tank, another pump and pipe line would be installed for this purpose. Return pipes and pumps for returning the water to the wharf would be installed, and a mechanical conveying plant for lifting the stored coal to the bunkers. The estimated cost is put at £10,000, exclusive of the mechanical conveyor, and it is proposed to submit detailed costs, if the Council approves of the scheme.

Poplar.—The Electricity Committee reported at the last meeting of the Council that, having regard to the fact that the showroom in East India Dock Road had proved self-supporting and had been of considerable benefit to the undertaking in the rapid extension of business, it had under consideration the question of providing similar accommodation at Bow.

Woolwich.—The L.C.C. has sanctioned the borrowing of the following sums for electricity purposes:—£1,500 for mains, repayable in 25 years; £1,100 for house services, repayable in 12 years; £630 for meters, repayable in 10 years; and £1,000 for electrical apparatus for hire-purchase, repayable in 10 years.

Dock Crane Equipment.—The Port of London Authority has recently reviewed the question of crane equipment at the Albert Dock, and it is proposed to replace 31 hydraulic cranes at present in use by 43 new electric cranes for lifting normally 30 cwt. loads and at reduced speed up to 3-ton loads. According to the *Shipping World*, one fact which has influenced the Authority, is that the working of electric cranes is less costly than that of hydraulic cranes. The displaced cranes are, however, to be utilised in the upper docks.

Loughborough.—Plant Extensions.—The T.C. on Monday decided to apply to the L.G.B. for loans of £14,000 for electricity purposes. Of this £11,000 is for a 1,000-KW. generating set for the supply of alternating current, and £3,000 for cables, meters, &c.

Manchester.—LOAN SANCTION.—The Corporation has received sanction from the L.G.B. for the borrowing of £45,000 (repayable within 24 years), and £30,000 (repayable within 15 years) for electricity purposes.

Melbourne (Derbyshire).—STREET LIGHTING.—The P.C., on the recommendation of the Lighting Committee, has approved of a scheme submitted by the Melbourne Electric Light and Power Co., for lighting the major portion of the town by electricity.

Middleton.—At a meeting of the T.C., on July 2nd, when the question of the lighting of the centre of the town was discussed, certain members urged that gas as an illuminant should be considered along with electricity. Councillor Wood, however, pointed out that the Council must recognise that, as the centre of the town had always been lighted by electricity, they would have to continue that method, or else pay a considerable sum to the Electricity Committee. They would like to have the centre of the town uniform, and they would certainly go into the question of gas with regard to the other parts of the town, in order to see if it could be done at the same cost.

Newport (Mon.).—The repairs in connection with the recent fire at the Corporation power station will cost about £1,000; a tender of the G.E. Co. to carry out repairs to plant has been accepted.

Oulton Broad.—PUBLIC LIGHTING.—The U.D.C. has requested the Oulton Broad Electricity Co. to submit a tender for public lighting.

Paisley.—The electric light installation at the Hawkhead Asylum, which has cost approximately £3,000, was formally inaugurated on June 26th.

Ripon.—The T.C. has received notice from a firm of its intention to apply for a prov. order for electric lighting in the city.

Rochester.—STREET LIGHTING.—In connection with his scheme for the electric lighting of the High Street, Mr. Harvey, engineer of the Kent Electric Power Co., has asked the Council's permission to put up an experimental installation which would, he states, enable the Committee to form an opinion as to the efficiency of the system, and would form the basis of an estimate for the cost of the whole system. Subject to the Corporation not being in any way committed to the adoption of the scheme, the necessary permission is to be given. The borough librarian, in his yearly report, complains of the need of some improvements in the lighting arrangements of the library, as, owing to the large number of gas burners necessary for efficient lighting, the library, he states, gets into a very close and unhealthy condition during the evenings.

Rochdale.—LOAN SANCTION.—The L.G.B. sanction has been received to the application for permission to borrow £30,000 for extensions to the electricity works.

The Electricity Committee has intimated to the Heywood Corporation that, owing to the applications it is now receiving for large supplies of electricity for power purposes, it does not feel warranted in undertaking to supply electricity in bulk to the Corporation.

Royton (near Oldham).—The U.D.C. has had under consideration the question of the supply of electricity by the Oldham Corporation to the Industry Mill, Royton, and has resolved that the Corporation be asked to canvass the district with a view to ascertaining the probable demand for electricity in Royton. The Council will then decide whether to apply for a special lighting order.

Sheffield.—ANNUAL REPORT.—The general manager (Mr. S. E. Fedden) reports that the total income of the electricity supply department from all sources during the year ended March 25th last, amounts to £116,210, as against an expenditure of £41,663, leaving a gross profit of £74,546. From this sum has to be deducted £24,078 for interest on productive capital, and £29,137 the annual instalment to be set aside out of revenue for the extinction of indebtedness, which leaves £21,330 as the net profit on productive capital. Allowing off this sum £5,701 in respect of interest on unproductive capital, and £4,114 in respect of the sinking fund on unproductive capital, and adding the surplus brought forward at the end of last year (£6,974), there remains (after deducting £10,000, the amount to be transferred to the renewals fund this year, £1,878 for special law charges, and £300 the amount to be set aside for the purchase of motors for hire) a net surplus of £6,312. The number of units sold during the 12 months under review, amounted to 21,671,978, while the cost per unit sold amounted to ·46d. The total working expenses amounted to £41,664, and the capital expenditure to March 25th last is put at £1,130,656. Mains are to be extended in various parts of the area at a cost of about £1,214.

A L.G.B. inquiry was held on July 3rd into the application of the T.C. to borrow £130,860 for the extension of the electricity undertaking. It was agreed to ask sanction for £83,200, the amount of tenders accepted, sanction to the remainder being deferred until an amended estimate of the other tenders was supplied.

South Africa.—The electric lighting supply to the Mowbray district, Cape Town suburbs, has been changed over from direct-current to alternating two-phase, 220 volts between outers and neutral. The supply to the Green and Sea Point district has also been changed over from 110 volts to 220 volts alternating.

South Shields.—PLANT EXTENSIONS, &C.—At a meeting of the T.C. on the 2nd inst., the Electrical Committee in its report recommended that the profit on the year, £3,156, be placed to the credit of the reserve fund. It also recommended the Council to apply to the L.G.B. for sanction to borrow £30,000 for the extension of the plant at the electricity works, including a new turbo-generator set, with condensing plant, air filter, rotary converters, &c., two water-tube boilers, with economisers, coal bunkers, conveyors, &c. Alderman Rennoldson, in moving the adoption of the report, said the profit last year was a record one. The Committee was of the opinion that the whole of the surplus should be carried to the reserve fund, which would then be £12,844. The capital of the undertaking was now verging on £200,000, and the reserve fund to be at all adequate should be £20,000. There would be a reduction in the fund in a year or two, when the new plant was installed, to the extent of something approaching £2,000. Referring to the proposed extension scheme, he said there was an absolute and urgent need for it. The new turbine set had been carrying almost the entire load ever since it had been installed; the plant was sufficiently loaded at the present time, and it would be risky to go further without an increase of plant, particularly when they remembered that the bulk of the local factories, dockyards and dry-docks, &c., were now entirely dependent upon the town's station for their power supply. Alderman Gibbon asked if the proposed outlay would have an earning capacity over and above the earning power of the present capital of the undertaking? Alderman Rennoldson said that it would, because they would be able greatly to economise with the new plant. They anticipated a big reduction in the cost for fuel; in fact, the engineer went so far as to say to the Committee that he saw his way quite clearly to make a saving which in amount would pay the interest and redemption on the new capital, and judging from what he had seen and the report, he (the speaker) believed it quite possible. They expected to get 17 years to repay the load. Alderman Bowman: That is about £2,000 a year in capital and interest. Do you mean to say you are going to save that on the new plant? Alderman Grant said their coal bill was something like £6,000 a year, and it was quite within the range of possibility to save £2,000. After further discussion the report was adopted.

The department has recently opened new offices, with a ground floor showroom and window display, surmounted by a Venner sign 60 ft. long. We understand from Mr. Ellis that this new departure is much appreciated locally.

Southend-on-Sea.—The T.C. has applied to the B. of T. for consent to the use of overhead transmission from Thorpe Bay Gardens to the borough boundary for the supply of current.

Staines.—It was intimated at the last meeting of the R.D.C. that the promoters of the Feltham and District Electric Lighting Order proposed making another application for a prov. order for electric lighting in the district.

Stoke-on-Trent.—The T.C. has decided to obtain a supply of electric cookers for hiring-out purposes. As the mains are not to be extended to Trent Vale, the Corporation Sewage Committee has decided to obtain a supply of current from the Tramway Co. for power purposes.

Stalybridge.—ANNUAL ACCOUNTS.—The electricity department shows an expenditure on capital account since the commencement of £266,229; loan debt, £206,983; and loans redeemed, £49,749. The income for the year amounted to £45,579, against an expenditure of £28,960, the gross profits amounting to £16,618. Interest on loans, &c., absorbed £8,274, and the amount transferred to sinking fund was £7,432, the net surplus amounting to £911.

Stowmarket.—WORKHOUSE LIGHTING.—The B. of G. has appointed a Committee to consider the lighting of the workhouse and the installation of telephones. At the meeting of the Board on July 3rd, the chairman (Mr. G. J. Gostling) suggested that it would be better to have the electric light installed. At present oil lamps are in use.

Sunderland.—A new turbo-generator, installed by the A.E.G. Electrical Co., was started on the 3rd inst. The new generator is of 5,000 KW. normal rating, but capable of carrying a load of 7,500 KW. for prolonged periods. Ald. Bruce, chairman of the Committee, said the total cost of the new plant, with all accessories, had been £22,000. The capital expended on the undertaking up to the end of March last was £453,927, and of that sum they had paid or reserved in the sinking fund £150,727. The profit last year amounted to £7,099 compared with £5,958 in the previous year, and the output was 13½ million units against 12 million units in the preceding year. He complimented Mr. Blackman, the borough electrical engineer, and said that gentleman had reduced the consumption of coal from 8½ lb. per unit sold in 1907 to 3½ lb. per unit sold last year.

Swansea.—LOAN INQUIRY.—A L.G.B. inquiry was held on Tuesday into the application of the T.C. to borrow £40,000 for electrical extensions.

Quite recently a brief strike took place at the Corporation Electricity Works, about 40 members of the Dockers' Union having left work after giving 24 hours' notice. The cause of the trouble was the dismissal of a man for lack of work; the Union claimed that he should be reinstated, and the latest addition discharged in his place. Ultimately the Council decided to recognise the principle of seniority urged by the Union, other things being equal, the men having returned to work.

Swinton.—The Salford Tramways Committee has agreed to allow the Council to fix 12 experimental fittings of the Barrow system of public lighting to tramway standards in Manchester Road, Swinton.

Tunbridge Wells.—The Electricity Committee has adopted the advice of the borough electrical engineer (Mr. R. N. Torpy) and reduced the price of energy for heating, cooking and power to 1d. per unit; this is a step in the right direction, and should be the means of bringing about a large increase of new business.

Wakefield.—The Electricity Committee has appointed a deputation to visit Huddersfield, Leeds, Coventry, Hertford and Barnes, to inspect the types of destructors used in those towns. It was reported at the last meeting of the Committee that the sanction of the L.G.B. to borrow a further £235 for electrical plant had been received; that electricity was to be supplied to Chevet Hall and Kettlethorpe Hall, and that the tender of the Victoria Coal Co. for the supply of 1,000 tons of unscreened slack for the electrical department had been accepted.

Walmer.—Messrs. Foote & Milne have informed the U.D.C. that they intend applying to the B. of T. for a prov. order for electric supply.

West Hartlepool.—L.G.B. INQUIRY.—Mr. H. R. Hooper, of the L.G.B., held an inquiry on the 1st inst., into the application by the Corporacion for sanction to borrow £4,330 for the purposes of the electricity undertaking. The town clerk explained that plant was required for the supply of current to the tramways which had been taken over by the municipality. The plant at the present generating station was now, he said, fairly well used up, but would probably last until the new station was in operation. The proposed change would also help the electricity undertaking by giving it an additional load in the day time. The space that would be available at the old generating station would be utilised to increase the shed accommodation for the cars. The Inspector asked if the plant they had purchased at the tramway generating station would be "scrapped," and the town clerk said it would be; they had to buy it when they purchased the tramways. The Inspector said he took it that the plant that had to be taken out to make room for the plant that was now being purchased had practically come to the end of its useful commercial life. That being so, the outstanding debt on that plant would have to be met by money other than loan—the amount would have to be deducted from that loan. Mr. Lambert (the borough accountant) said they had a reserve fund of about £5,000. There was no opposition, and the inquiry closed.

Alderman Mafarlane, chairman of the Electricity Committee, speaking at the subsequent meeting of the T.C., said the tender which they proposed to accept was lower than had been anticipated, and enabled them to reduce the amount they would require on loan from £4,330 to £3,900.

Wimbledon.—Electrical energy is to be supplied to the garage proposed to be erected by the London General Omnibus Co., in Merton High Street, at 1½d. per unit for all current consumed, subject to (1) a guaranteed minimum consumption of 20,000 units per annum; (2) the maximum demand not exceeding 30 KW.; and (3) the supply being taken for a period of not less than three years.

York.—SUPPLY TO ADJOINING DISTRICTS.—The Electricity Committee has recommended the City Council to apply to the B. of T. for permission to extend the area of supply to include Great Ouseburn, Bishopthorpe, Escrick, Tadcaster, Flaxton and Easingwold.

TRAMWAY and RAILWAY NOTES.

Australia.—The purchase of the Perth, W.A., tramway system by the Government was completed on June 30th, and the lines were taken over on that date.

Birkenhead.—At a recent T.C. meeting, Mr. H. B. Webb brought forward a motion that the Wallasey Corporation should be approached with a view to establishing a better means of communication between the two boroughs by running railless electric cars or motor-cars over the most suitable route between both towns. The distance to be covered between Cleveland Street and Wheatland Lane, Seacombe, across the Duke Street bridge, was 1,840 yards, and the total cost of erecting overhead wires would approximately be £1,200. For the service they would probably require four cars, each of which would cost £750. Mr. H. Halsall, chairman of the Tramways Committee, suggested that the resolution should be withdrawn for the time being, as the Committee would shortly have before it a big scheme for the development of the tramway service. In the circumstances, the motion would only hamper the Committee. Mr. Webb agreed to withdraw the motion.

Birmingham.—The City Council has had under consideration the scheme for the linking up of the tramways. The proposal to connect Navigation Street with Corporation Street, *viâ* Stephenson Street, was rejected, and the suggestion as to the linking up of Broad Street with Colmore Row, *viâ* Victoria Square, was referred back to the Tramways Committee. All the other proposals, including that for a double line of tramways along *d* Street, were agreed to.

Blackburn.—The income from the tramways undertaking of the Corporation for the year ended March 25th last was £66,793, and the expenditure £62,923, leaving a profit of £3,870, of which £2,000 has been allocated towards the relief of the rates. The provision for the redemption of debt was £14,909.

Bradford.—ANNUAL REPORT.—The working of the Corporation tramways department last year showed a net profit of £41,921, as compared with £52,783 in the previous year, a decrease of £10,662. The traffic income was £279,523, an increase of £6,044, but owing to an increase in mileage of 271,000, the income per car-mile was only 11·3d., as compared with 11·6d. Of an increase in drivers' and conductors' wages of £4,458, £2,000 was in respect of advances, and £2,500 in respect of increased staff. The Committee's contributions under the National Insurance Act were £530. The income on the railless trolley section was £1,233, or 7d. per car-mile, whilst the expenditure in this section had been 9d. per car-mile, resulting in a deficit in the section of £380. It is pointed out, however, that the railless section is a valuable feeder to the tramways. The decrease in profits is accounted for partly by the adoption of ½d. fares on cars before nine o'clock in the morning, and partly by the bad weather of last summer, which resulted in small patronage of the cars on the holiday routes.

The city engineer has received instructions to proceed with the construction of the tramway across Cottingley Bridge. The Council is urging local Members of Parliament to vote for the deletion of the clause inserted in the L.C.C. (Tramways and Improvements) Bill giving the L.U.T. Co. compulsory running powers over tramways now being acquired by the Council from the company.

The Corporation tramway men have demanded a general increase of wages, and have intimated that this demand is not intended to take the place of the general revision which is due to take place next February.

Brazil.—The Electric Tramways of Ribeirao Preto, Ltd., an English company, with a capital of £210,000, has secured the necessary Government authorisation to construct and work a system of electric tramways at Ribeirao Preto, in the State of Sao Paulo.

Continental Notes.—HOLLAND.—According to some figures recently issued by the Dutch Institution of Engineers, there are now eight electric tramways, four light electric railways, and one ordinary electric railway in Holland. The total length of the same being about 370 miles.

GERMANY.—According to the official returns lately issued, out of 550 light railways in Germany at the end of 1211, 210 were electrically operated, while of the 246 tramway undertakings in the country 84·2 per cent. were equipped for electric traction.

Dewsbury.—In connection with the suggested construction of tramways to Dewsbury Moor there appears to be a rather more optimistic feeling prevalent than for some time past. This is in consequence of an inspection of the district by the National Electric Construction Co. as a result of which it has expressed itself as being more favourably impressed with the possibilities of the Dewsbury Moor line, than it was when it last visited the district.

The Corporation has decided to apply to the B. of T. for the prolongation for a further period of two years of the Dewsbury Corporation Tramways Orders, 1911 and 1912, which imposed an obligation to commence the proposed tramway services to Dewsbury Moor and Shaw Cross by the end of the present month.

Glasgow.—TURBO-ELECTRIC LOCOMOTIVE TRIALS.—During the last two or three years trials have been carried out on the railways in the vicinity of Glasgow, with a steam turbo-electric locomotive constructed by the North British Locomotive Co. This machine which is now undergoing further tests, is described by the *Railway News* as follows:—Steam is generated in a boiler of the ordinary locomotive type, which is fitted with a superheater, and the coal and water supplies are carried in the side bunkers and in the side water tanks at both sides of the boiler. The steam from the boiler is led to a turbine of the impulse type running at a speed of 3,000 R.P.M., to which is directly coupled a continuous-current variable voltage dynamo. The dynamo supplies current at pressures varying from 200 to 600 volts to four series-wound traction motors, the armatures of which are built on the four main or driving axles of the locomotive. The exhaust steam from the turbine passes into an ejector condenser, and is, together with the circulating condensing water, delivered eventually to the hotwell.

The condensation of the exhaust steam deprives the locomotive boiler of the usual exhaust blast which induces the draught through the firebox and boiler tubes. In the experimental locomotive the induced draught is replaced by forced draught provided by means of a small turbine-driven fan. The fan is placed within the cooler, so that it will deliver hot air to the boiler fire, and at the same time assist the current of air through the cooler. The small switchboard and the instruments required, the controller for grouping the four motors in series—series-parallel and parallel, according to the draw-bar pull to be exerted—and the regulator for controlling the voltage in the electrical circuit, and consequently the speed of the train, are all placed on the driver's platform within easy reach.

Hove.—With reference to the two resolutions recently passed by the T.C. in regard to the proposed trolley 'bus scheme (see our issue of June 13th under this head), the town clerk of Brighton has written to the General Purposes Committee informing it of the decision of his Council to adopt the "under-running"

type of overhead equipment for Brighton, including the "through routes." "With regard to the first of the resolutions passed" (the letter continues), "the double-deck trolley 'bus has been officially submitted to the Board of Trade for approval, and the reply of the Board may be looked for in the course of two or three weeks. With regard to the second of the resolutions my Council are of opinion that the construction of an experimental route is unnecessary, as railless traction systems on the 'under-running' system are working in this country, from an inspection of which all necessary information may be obtained." The clerk enclosed a description of the system of equipment and apparatus proposed to be adopted, and asked the Hove Corporation to agree to the same system for the purposes of the "through routes." The General Purposes Committee has referred the letter to the Traction Committee with instructions to consider the system of overhead equipment submitted (particularly as to whether such system is that most adapted for use in Hove, and with double-decked cars), with power to take expert advice thereon, and, if necessary, view any systems at work.

Edinburgh.—After discussing the Colinton tramway extension proposals, the T.C. has declined the offer of the Colinton Tramway Co. to sell its undertaking. The convener of the Tramway Committee said the Corporation should supply electric light from its power station for the lighting of the Redford Barracks, and the War Office should be asked to make its own arrangements for a connection between the Barracks and Slatefold, the Corporation giving running power over its tramway. The Committee was unanimous with regard to the passenger communication to the Barracks, that the natural and proper line to be extended was the Gilmore Place line. Several notices of motion were given at the last week's meeting of the Council proposing tramway extension to Corstorphine, Redford and Dreghorn districts.

Folkestone.—At the last meeting of the T.C., the Town Clerk reported that the Folkestone, Sandgate and Hythe Railless Traction Bill had been withdrawn by the promoters.

Glasgow.—Everything points to Parliamentary powers being sought by the T.C. for another tramway extension not included in the list provisionally adopted in the spring of the present year. The latter, it may be recalled, contained many important augmentations, among them being the lengthening of the lines from Cathcart to Clarkston, from Burnside to Cathkin braes, and from Baillieston to Coatbridge. So far as these are concerned, negotiations are proceeding between the T.C.'s Tramways Committee and the various local authorities and others interested in order to avoid, if possible, costly and protracted litigation. The latest scheme affects the centre of the city purely, and is designed so as to relieve the congestion at Jamaica Bridge, the main cross-river viaduct over which no fewer than five different route cars cross, to say nothing of a particularly heavy general vehicular traffic. The projected line will start at Cowcaddens, where it taps the red line to Maryhill and the blue line to Lambhill and Keppochhill Road—and proceed directly north along Hope Street, cutting across Argyle Street and down Oswald Street. There the difficulty of crossing the Clyde is encountered before it can be continued to Commerce Street and linked up with the main line in Nelson Street, and both the Tramways and the Statute Labour Committees have been considering the difficulty. It was distinctly stated some months ago by the convener of the Tramways Committee that if a relieving bridge was constructed, his Committee would make a substantial contribution. Now it appears that this promise has been somewhat gone back upon, and the proposal of the Statute Labour Committee is rather open—that the proposed bridge be constructed either at the foot of Oswald Street or Robertson Street, which is further west. The general opinion seems to be that the Oswald Street proposal will be favoured.

In committee a proposal by Mr. Izett to inquire into the feasibility of instituting a season ticket system for the Corporation Tramways was negatived by 21 votes 2.

At the same meeting, and by a majority, it was agreed to recommend the T.C. that the general manager (Mr. Dalrymple) be authorised to visit American cities, with a view to acquainting himself with the most modern and up-to-date methods of tramway traction.

Halesowen.—The U.D.C. has been informed by Messrs. Balfour, Beatty & Co. that they have decided to abandon the construction of the proposed electric tramways in the Halesowen area. This decision, it is understood, is in consequence of obstacles placed in the way by the Birmingham T.C. The order was granted in 1900 to the U.D.C., and was disposed of to the Empire Lighting Co., whose powers were subsequently acquired by Balfour, Beatty and Co.

Japan.—Charters to two new light electric railways have just been granted by the Japanese Government—one to the Owari Electric Railway Co., for a projected line 21½ miles long, and one to the Mariko Electric Railway Co., for a line 5 miles in length.

London.—L.C.C.—The General Purposes Committee recommends the Council to become a member of the International Tramways Congress, 1914, also that the chairman and the vice-chairman represent the Council thereat.

The Tramways Committee has had under consideration the question of the tramway renewals and reserve funds, the former of which was to be reconsidered at the expiration of five years from June, 1908. Based on an annual mileage of 56,000,000 car-miles, it estimates that the required amount to be placed to renewals is ·635d. per car-mile, as against ·66d. originally estimated. The total expenditure on renewals for the next five years is estimated to be £695,000. The renewals fund at March 31st last amounted to £633,010, while in addition the general reserve fund amounted to £273,786. The Committee finally recommends that for two years any surplus on the tramway working shall be paid into the renewals fund, and that the matter shall be reconsidered at the end of that period

Longbenton.—The U.D.C., at its meeting on Friday last, decided to invite the Newcastle-on-Tyne Corporation to extend its tramway system into, or through, the Council's area.

Newcastle-on-Tyne.—B. of T. Accident Inquiry.—Col. von Donop held an inquiry on the 2nd inst. into an accident which occurred on Westgate Hill on June 21st, when a car that had been reported for defective brakes, and was being removed to the sheds, ran away and collided with another car, whereby several persons were injured.

Motorman Joseph Nugent said when he went on duty he took over the charge of the car on the Elswick Road—Chillingham Road route—and made two complete circular trips, and was satisfied with his brakes. On the third trip the conductor drew his attention to the fact that his brake at the rear end of the car was wrong, the chain shaking. He informed time-keeper Fairless of the fact. Witness suggested that as it was a circular route, and as he was at the good end, he should go round the route and change cars at Elswick terminus. The time-keepeer agreed to him completing his trip.

Col. von Donop: I think the time-keeper took a certain amount of responsibility off your hands in agreeing, but I am not sure that you were right in continuing in face of your rules.

Witness said he completed the trip, and at Elswick terminus he handed the car over to timekeeper Fairless and fitter Irwin, and took over another car.

Timekeeper Fairless, examined by Col. Von Donop, said he knew all the rules and considered that as it was a circular route, and Nugent had said he could manage, there would be no harm in letting the car make another round of the circular route, despite the rule against allowing such a car to run. Witness said the route was safely completed, and Irwin and he took over the car at the terminus, Irwin driving and witness being on the rear platform. The end of the car then in front was the one at which the hand-brake was defective. They proceeded to take the car to the Wingrove sheds, and the car was brought to a stop by means of the magnetic brake. After the car stopped he applied the hand-brake and shifted the trolley. While he was doing this the car began to move forward, and he shouted to the motorman, but got no reply. Witness tried to get the trolley on, thinking that the magnetic brake would pull up the car again; he tried to jump on the car with the trolley rope in his hand, but could not do so owing to the weight of the trolley; the rope seemed to have got about his legs, because he was flung to the side of the street. After the collision he examined the hand brake at the end of the car, and found it still hard on, and the "dog" was still in.

Benjamin Irwin, the fitter who took charge of the damaged car, said he brought the car up short of the points leading to Westgate Hill, and intended to shift the points with the point bar. He turned round to get the bar, and was reaching over the front of the car to do so, when he found the car gliding away. He had stopped the car with the magnetic brake, and, as far as he knew, Fairless had not applied the hand brake. He fully expected that the hand brake would have been applied at the back to keep it standing. He felt sure at the time the car moved that the magnetic brake would bring it up, and he did nothing until he got on to the top of the hill, when he knew that there was something seriously the matter. At the top of the hill the speed of the car would be 8 to 10 miles an hour. He saw a car in front of him, and whistled to the conductor of it to give him warning. As soon as he saw the man clear off his platform witness went to the back of his car and applied the hand brake, which had not been applied at all; it seemed to be having the effect of lessening the speed, but they were then into the other car.

Mr. Ernest Hatton, general manager, said he gave instructions to have the damaged cars removed to the Byker sheds and locked up until a proper inspection could take place. On Monday morning he had the controller at the damaged end of the car taken out of the car into which it had been placed after the collision. Beyond the controller inside being covered with fresh dust, due to the force of the collision, it was in perfect order. Both motors were also in perfect working order. The car was badly damaged, and the magnetic brake was all twisted. Without doing anything to it at all, he had the car taken into the yard, and they tested its electrical equipment as it stood, with the remaining controller, and it worked perfectly on every notch. The hand brake also was tried, and it still was well able to control the car.

This concluded the evidence, and the inquiry terminated.

Salford.—The Corporation has approved of an agreement with the Prestwich U.D.C. with reference to the widening of a portion of Bury Old Road, and the construction of a double line of tramways along that road.

Stalybridge.—Annual Accounts.—The abstract of accounts of the Tramways and Electricity Board shows expenditure on capital account in the tramways department since the start in 1904 to March 31st last amounting to £279,778; the loan debt amounted to £224,700, and the loans redeemed to £56,289. The revenue account for last year shows income amounting to £36,637, and expenditure totalling £28,884, the gross profits for the past year being £6,753. Interest on loans, &c., absorbed £8,570, and the amount transferred to sinking fund was £7,307, leaving a

deficit on the year's working of £9,124. The passengers carried numbered 8,896,836, as compared with 10,256,918 in the previous year.

Warrington.—The new motor-'bus service proposed by the Electricity and Tramways Committee of the Corporation was inaugurated last week.

TELEGRAPH and TELEPHONE NOTES.

Austria.—According to *Der Elektrotechniker*, the Austrian telephone credits for the current year remaining for expenditure amount to 12,000,000 kronen, which, with the 7,000,000 kronen unspent last year, makes a total of 19,000,000 kronen. The new programme is to be fixed for several years in advance, and if the procedure of the last programme be followed, will mean the outlay, over and above the regular yearly credit, of a special credit of some 20,000,000 kronen. The new programme contemplates the erection of exchanges, the creation of new interurban lines, and the enlargement and reconstruction of networks.

Boy Scouts and Wireless Telegraphy.—The 1st Dorchester Boy Scouts attached to Mr. A. V. Dodderidge's Commercial School have now a wireless telegraph station. It has a receiving radius of between 500 and 600 miles, and communications have been taken from Cleethorpes, Eiffel Tower (Paris), and Norddeich. The transmitting set is not yet installed; the whole of the apparatus is being fitted, and instruction is to be given to the boys, by Mr. Hopkins, assistant scoutmaster, who is a certificated wireless telegraph operator. Special advantages will shortly be offered by the Marconi Co. to boys who have been trained in wireless telegraphy, and first and second-class certificates of proficiency will be given, also valuable prizes, such as complete sets of Marconi field telegraph apparatus.

The Goldschmidt System.—The Anglo-French Wireless Co. state that trans-Atlantic wireless communication has been established by means of the Goldschmidt system between Hanover, in Germany, and Tuckerton, near Atlantic City, U.S.A., a distance of 3,600 geographical miles. This was done in the daytime with an entirely new type of receiving apparatus, the sending power being 150 KW.

Imperial Wireless System.—On Friday last in the House of Commons, Mr. Samuel explained the policy of the Government with regard to the erection of the stations for the Imperial wireless system. A new contract had been made with the Marconi Co. for the erection of the stations, which, as before, would become the absolute property of the Government, and would be worked by the Government staff; owing to the rise in price of materials, the cost of each station would be increased by about £6,500. Interest would be paid at the rate of 2 per cent. on 30 per cent. of the purchase price from the date of signing the contract, on 30 per cent. for a period of nine months thereafter, and on 30 per cent. from the completion of the stations until the final settlement. The company absolutely declined to accept the contract unless the 10 per cent. royalty on the gross receipts was retained in the agreement. The sites for the six stations had been secured. No other firm could be relied upon to erect stations of a satisfactory character; the Post Office could not do it, and the Admiralty staff was fully employed on Naval business, from which it could not be diverted with serious detriment to Naval interests. There was no engineer in the country outside the Admiralty and the Marconi Co. who had actual experience with long-range stations and could take charge of the work. It was not the fact that the Government could use the patents of the Marconi Co. without the payment of royalties. Moreover, delay was inevitable unless the work was given to the Marconi Co., which had the designs and staff ready for an immediate start.

The contract was not to be binding on the company unless ratified before August 31st this year. A provision accidentally omitted from the former contract had been inserted, under which the company, while guaranteeing to work under all conditions at 20 words a minute, was not required to guarantee automatic working at that speed under all circumstances.

In a supplementary statement, Mr. Samuel showed that the royalty would be paid on each station separately, and only on stations in which Marconi patents were employed. The Government could call upon the company at any time to cease work upon the South African, Indian or Malay stations if it desired to install other apparatus, subject to payment for the work done, and to an opportunity being given to the company to show that it could provide apparatus of equal economy and efficiency. The stations would at all times be available for Government experimental work. The company was now able to raise the guarantee for automatic working from 50 to 75 words a minute, except during strong electrical disturbances of the atmosphere. The provision that the Government should seek the advice of the company when contemplating the installation of another type of apparatus was to be dropped, and the company's right of inspection of apparatus alleged to infringe its patents had been modified, in that an independent engineer of high standing was to make such inspection. The contract will be submitted to Parliament for discussion before it can become binding.

In reply to a question as to the reopening of negotiations with the Marconi Co. for the supply of Imperial wireless stations, while Ministers held shares in the American Marconi Co., the Prime Minister stated that the Ministers had taken steps to divest themselves of any interest in the shares of the American company.

The Telephone Service.—In reply to a deputation from the London Chamber of Commerce with regard to defects in the telephone service, the Postmaster-General on Friday last admitted that the service had not yet reached the standard of efficiency that was desirable; regarding the complaints of overcharges, he said there were one million calls a day in London, and it would be impossible to conduct the service if the Post Office record were not accepted as conclusive. The Post Office engineers were trying to devise a meter which would solve the difficulty. The number of ineffective calls due to the inadequacy of the junction lines last year was less than ½ per cent. During the present financial year about £3,000,000 was being spent on new construction and development, and he was going to ask for the sanction of Parliament to borrow £10,000,000 for the development of the telephone system during the next few years; this money would be provided out of the funds in the hands of the National Debt Commissioners. Nearly half the trunk calls were between 10 and 12 noon, and it was, therefore, advisable to avoid those hours if possible. The Post Office was spending £300,000 on a new underground cable from London to Birmingham, which would provide three times the present number of wires, and would help the service to the north and west of England. £1,800,000 was now being spent on the development of the trunk service.

The number of women operators in London had been increased by 1,335, and of male night operators by 201. The average speed of answering calls was five seconds. His policy was to effect no change in the existing system of rates until the whole question had been investigated. In seventeen large towns advisory committees had been set up to confer with the Post Office on telephone matters, and 12 more were in course of formation.

The Telephone Transfer.—In reply to a question in the House of Commons, the Postmaster General stated that the award of the Railway and Canal Commission assessed the value of the National Telephone Co.'s plant, property and assets purchased by the Post Office at £12,515,264. The company were also allowed their costs in the valuation proceedings. An appeal against two items of the valuation was lodged by the Post Office, and a cross-appeal against the award generally by the company. Under an arrangement made between counsel, subject to Treasury approval, the appeal and cross-appeal were withdrawn, on condition that the purchase price of the plant and other property should be reduced by £45,000, and the company should waive the payment of their costs, for which a claim of £122,000 had been made. The total sum payable to the company was, therefore, reduced to £12,470,264, which compared with the original claim of the company of £20,924,700 for plant, &c., and £122,000 for costs.

CONTRACTS OPEN and CLOSED.

OPEN.

Abergele (North Wales).—July 12th. One 9—11-KW. steam dynamo, erected complete at the Sanatorium, Plas Uchaf, for the South Manchester B. of G. Specifications from Mr. F. W. Page, consulting engineer, 14, St. Ann's Square, Manchester. Deposit £2 2s.

Australia.—VICTORIA.—August 4th. (*a*) Twin surface condensers, hotwells, piping and sundries; (*b*) air and water extraction pumps and motors; (*c*) circulating water and sump pumps, with motors, for the Melbourne Suburban Railways power house. See "Official Notices" June 13th.

September 16th.—Switchboard, C.B. or automatic or semi-automatic, at Collingwood. See "Official Notices" to-day.

August 19th. 105 miles paper-insulated, lead-covered cable. See "Official Notices" to-day.

September 9th.—Common-battery multiple switchboard. See "Official Notices" to-day.

QUEENSLAND.—August 27th. Five sections of common-battery multiple switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

September 10th.—Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

WESTERN AUSTRALIA.—July 19th. Switchgear and accessories for an electric power station at Perth. See "Official Notices," June 27th.

SOUTH AUSTRALIA.—August 13th.—Common-battery switchboards and telephone parts for Adelaide. See "Official Notices," July 4th.

NEW SOUTH WALES.—August 20th. Pneumatic ash-handling plant for the White Bay power house. Specification No. 415 (5s. each) from Electrical Engineer's Office, 61, Hunter Street, Sydney.

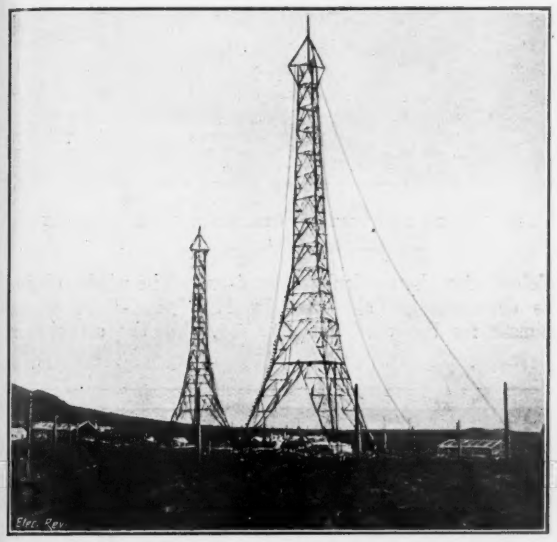
August 27th. Telephones, switchboards and incandescent lamps, for the P.M.G. See "Official Notices" to-day.

(*Continued on page* 64.)

A SIBERIAN WIRELESS STATION.

[BY OUR BERLIN CORRESPONDENT.]

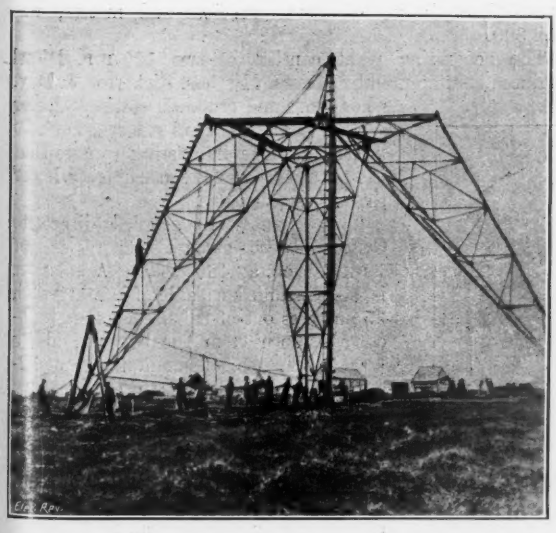
The equipment of the Telefunken station at Nayachan, Siberia, which was carried out by the Russian Siemens and Halske Works to the order of the Russian Postal Department, is a remarkable feat of engineering skill.



The Nyachan Wireless Telegraph Station.

The staff at the disposal of the Russian firm comprised an engineer, two fitters for radio-telegraphic apparatus, one mechanic, one fitter for erecting the tower, and 39 auxiliary hands engaged at Vladivostock. The expedition was also accompanied by a physician.

The entire staff, with the whole of the apparatus and materials, sailed from Vladivostock on June 19th, 1912, on the ss. *Sichan*, which was specially chartered for the purpose.



Wireless Tower During Erection.

The steamer arrived at Nayachan on June 26th, but, on account of the unfavourable weather and tide, the materials could not be unloaded before July 4th. The unloading was rendered more difficult by the fact that the steamer had to come to anchor about two miles from the shore, small boats with a carrying capacity of 8 tons being used to transfer the materials to the land.

Nayachan is a small village of about 30 inhabitants at the mouth of the river of the same name, on the Sea of Ochotsk, situated in 60° 30′ northern latitude. Its climate is cold, the mean summer temperature being + 8° C., and the mean winter temperature — 30° C. Summer begins in the first half of June, and lasts until the first half of September.

On July 11th, when the whole of the materials had been landed and the tents put up, the installation of the two iron towers, 75 m. high, was commenced. On September 1st, that is after 51 days, both towers were completed, and four days afterwards the antenna and counterweight had been stretched out and the first provisional receiving tests were performed.

Since the ground, even in summer, only thaws to a depth of about 30 or 40 cm., the laying of the tower foundations involved much difficulty. The pits dug out kept filling with water from the thawing ice, which had to be removed continuously, while the pits would increase considerably in size, as the walls were thawing and falling down. No concrete foundations were used; the feet of the towers were anchored on substantial wooden planks covering the

Upper View Showing Telegraphic Material Being Landed; Lower View, of Erector's Tent.

bottom of the foundation pit in the frozen ground, being embedded in a concrete layer about 70 cm. in thickness which was covered by a peat layer about 1½ metres thick, so as to protect the ground round the tower base against any risk of thawing in summer.

On September 23rd the station building was sufficiently advanced for the installation of the machinery and electrical apparatus to be commenced. On October 13th, that is, in the extremely short time of 20 days, the two machines—viz., one radio-telegraphic sender of about 28 H.P. primary energy (7·5 KW. in the antenna) and an additional sender of about 3·5 KW. primary energy (1·5 KW. antenna energy) for communication with ships, the receiving apparatus and the electrical tuning had been completed. After three days' tests by the Official Committee the station was taken over, and the official inauguration took place on October 25th.

The wireless station of Nayachan communicates with the following stations:—Novc-Mariinsk, 990 km.; Ochotsk, 910 km.; Petropavlovsk, 985 km.; and Nicolayevsk, 1,460 km.

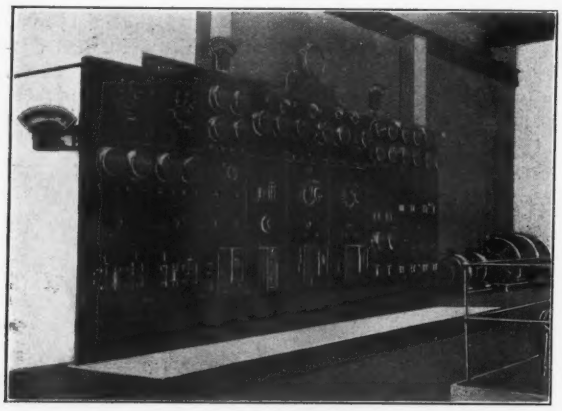
According to contract, communication had to kept up daily during eight hours with Novo-Mariinsk and Ochotsk,

whereas a wireless service with Petropavlovsk and Nicolayevsk had to be ensured by night during eight hours. The acoustic intensity—with a tuning accuracy of 5 per cent.—had to be 200 units as a minimum.

As a matter of fact, these guarantees were far exceeded, the following data being obtained on the delivery of the station:—

Corresponding station.	Distance.	On land.	On water.	Acoustic intensity.
Novo-Mariinsk	... 990	Only land		0·5 units
Ochotsk ...	... 910	"	"	0·5 "
Petropavlovsk	... 985	300 km.	685 km.	3·0 "
Nicolayevsk	... 1,460	60 km.	1,400 m.	3·0 "

At the same time wireless communication to 1,000 km. distance was effected between the station and the ss. *Sichan*,



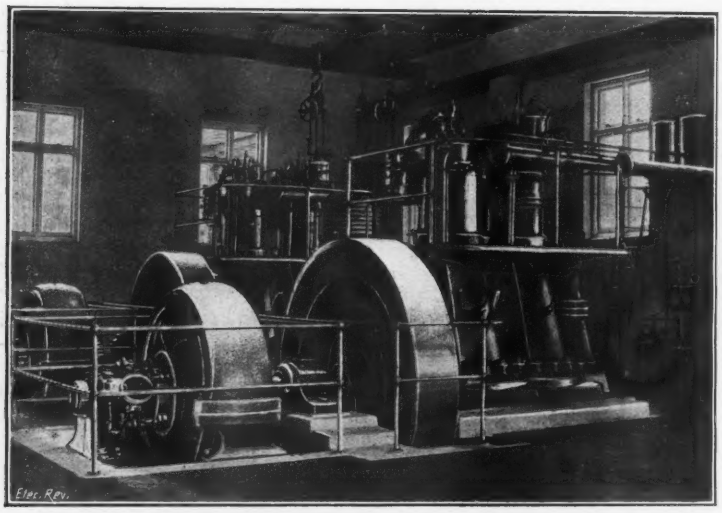
Main Switchboard, Queenstown Electricity Works.

which during the erection was equipped with a ship station of 3 kw. primary energy and an antenna mast 20 m. in height, the acoustic intensity being 50 units.

QUEENSTOWN (CAPE COLONY) ELECTRIC LIGHTING.

[from our South African correspondent.]

One of the most recent South African towns to inaugurate an electricity undertaking is the Municipality of

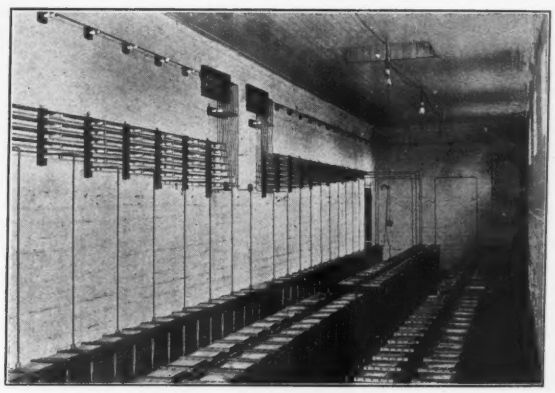


Diesel Engine Sets at Queenstown, Cape Colony.

Queenstown, which has a population of 3,775 white and 5,000 coloured people. Though a small installation, it is nevertheless interesting, being a departure from the usual practice as Diesel oil engines have been installed. The plant was started up on November 9th last year, and bids fair to have a very successful career; Mr. W. Bellad-Ellis is the municipal electrical engineer, to whom we are

The Generating Station, Queenstown, Cape Colony.

indebted for the particulars here given. The whole scheme was designed and laid down by Mr. Bellad-Ellis, whose estimate for the work was £12,800, while the actual sum



Battery Room, Queenstown Electricity Works

expended, exclusive of house services and meters, was £12,300.

The generating plant consists of two 100-h.p. Diesel engines manufactured by Messrs. Mirrless, Bickerton & Day, which consume crude oil costing 9d. per gallon; the engines run at a speed of 250 r.p.m., and it is interesting to note that the running costs are consideraly lower than for suction gas.

The engines are coupled direct to G.E.C. direct-current generators of 70 kw. each, at 460 volts. A balancer is also installed capable of dealing with 35 amperes out-of-balance current without assistance from the battery; also a booster capable of maintaining a 72-ampere charging rate to the battery, both these machines being supplied by the G.E. Co.

The battery consists of 258 Tudor cells of 190 ampere-hours capacity, and it carries the light load as well as assisting during the peak load.

The plant is housed in a brick building, 60 ft. long × 50 ft. wide, which again is a departure from the usual wood and iron building and steel stack.

The switchboard was supplied by the G.E. Co., and consists of two generator and nine circuit panels, also booster, battery and balancer panels, and is fitted with the usual recording instruments, &c.

The distribution is on the three-wire system (220-440

volts D.C.), being partly overhead and partly underground; the underground cables were supplied by Messrs. Henley, and consist of two, three and four-core cables of from ·15 sq. in. to ·0125 sq. in. section, all armoured and paper-insulated, there being a total length of 6½ miles. The overhead routes have a total length of 16 miles, and consist chiefly of No. 00 bare copper wire, carried on 25 to 35 ft. Mannesman steel poles, numbering about 550.

During the few months of running, 328 consumers have been connected for lighting, as well as a few small power consumers, all connections being made overhead through pole fuses. Ferranti meters are used, and the price of current is 1s. per unit for lighting, and 6d. per unit for power. The street lighting is by means of Osram lamps, and consists of 56 100-C.P. and 180 50-C.P. lamps, spaced about 100 yd. apart, the mileage of streets lighted being 13 miles. The lamps are extinguished at 11.30 p.m.

The contractors for the installation were Messrs. Bellad-Ellis & Co., of Port Elizabeth.

SUBMARINE POWER TRANSMISSION IN THE BALTIC.

The electrical and daily Press a short time ago announced that a large Swedish electricity company had concluded a contract with the largest Danish electricity and tramway company, according to which the Swedish company was to lay a high-tension cable from its inland power station to a place on the coast north of Helsingborg, whence a submarine cable was to be taken across the sea to Helsingör. This extremely interesting scheme of power transmission by high-tension submarine cables has, however, three predecessors of recent date, the Isle of Rügen and the Peninsula of Wittow having for some months been supplied from the Stralsund power transmission station, and the Isle of Fehmarn from the Lübeck power house.

In order to supply the Isle of Rügen with electricity, Messrs. Siemens-Schuckertwerke, in the summer of 1912, laid two high-tension cables, from the Stralsund power transmission station through the Stralsund Bay as far as Rügen, the way across the small island of Dänholm being chosen in order, if desired, to supply current there also.

The particulars of the cable are as follows:—Working voltage, 15,000; copper cross section, 3 × 35 sq. mm.; number of cores, three; insulation, impregnated paper; protection, lead sheathing and armour of round iron wires.

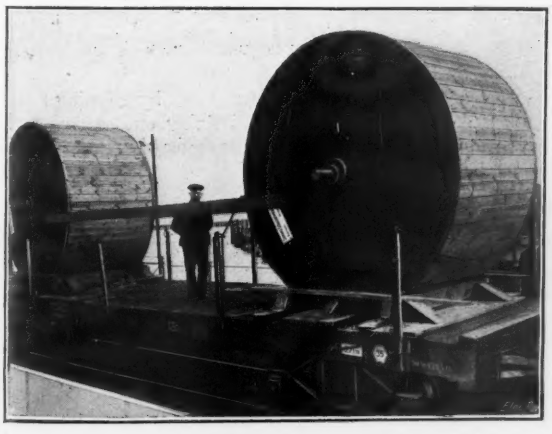


Fig. 2.—Large Cable Drums.

The submarine cable connecting Stralsund with Dänholm is 335 m., and that between Dänholm and Rügen 1,350 m. long. In the latter section a coupling sleeve had to be inserted in each cable, as a single cable length of 1,350 m. would have entailed a considerable increase in the cost of manufacture and transport. The two cables connected by the sleeve were 750 m. and 600 m. long respectively, the weight of a cable drum, inclusive of 750 m. of cable, being about 19,000 kg. This is the first instance of high-tension coupling sleeves being fitted at sea.

From the bus-bars in the power transmission station the two cables were first taken to a small intermediary station on the Island of Dänholm, before terminating at the large sub-station on Rügen, the starting point of the overhead conductor system covering this island.

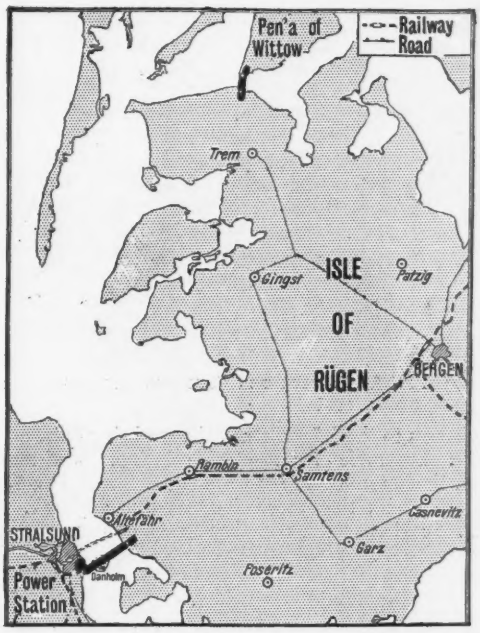


Fig. 1.—Map of Submarine Power Cables.

The submarine cables designed for this installation were supplied on six cable drums, the two largest of which were each 3 m. in diameter and 1·8 m. in width (fig. 2). These cable drums were transported by rail as far as Stralsund, and there taken on the Royal railway department's ferry-boat to the crane of the Royal shipyards.

Two barges coupled close together sideways by iron girders were used in laying the cables. These barges carried the wooden trestles into the bearings of which the cable drums were fitted. They were so arranged that first the two drums comprising 750 m., and subsequently those comprising 600 m. of cable, could be fitted into the two trestles and paid out. After laying the four cables, their ends were attached to a third barge moored in the water, on board of which the connection sleeves were eventually inserted.

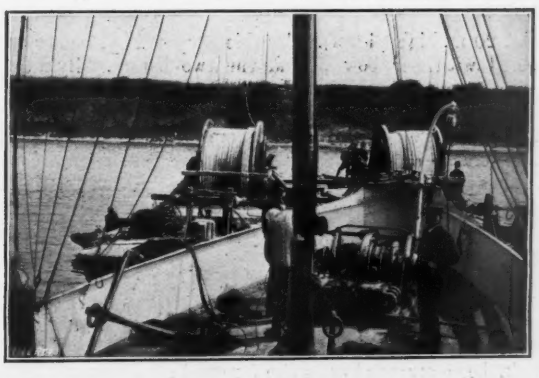


Fig. 3.—Hauling the Cable End up the Shore of the Isle of Rugen.

Operations were commenced on the coast of Rügen and ended at Dänholm, trenches 6 m. wide and 1 m. deep being, at the Rügen and Dänholm ends, dredged into the sea to

200 m. distance from the coast, on account of the shallowness of the water.

On June 20th, 1912, at 6 a.m., a steamer took the two

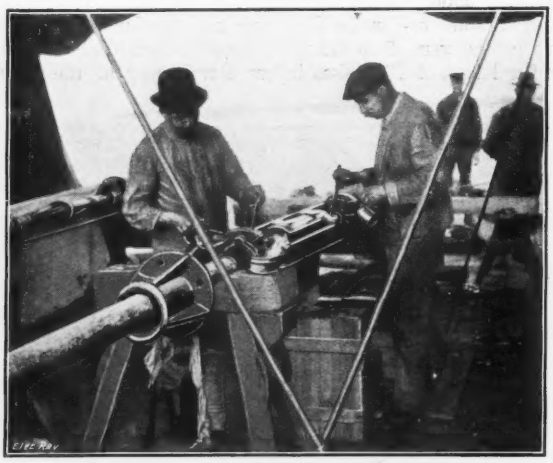


Fig. 4.—Fitting the Coupling Sleeves

cable barges to the Rügen coast, the sea being quiet and the weather favourable for the cable laying. On reaching Rügen, the barges could not be brought nearer than 150 m. from the shore, the water being only 2 m. in depth. This 150 m. of cable, as well as another length of 40 m. for installation on land, thus had first to be hauled up the steep bank

Fig. 5.—Lowering the Joint into the Sea.

about 20 m. high (fig. 3). For this purpose the steamer was moored with her bow behind the two barges. By means of the steam capstan on board the steamer and a steel hawser about 20 mm. in diameter carried over a pulley on shore, the submarine cables were hauled up the bank, this operation being completed towards noon. On account of a heavy gale blowing in the afternoon, the continuation of cable laying had to be postponed until the following day. The cable barges were moored, and the trestles were secured against the storm by struts installed between the drum disks and by lashing the drums to the barges by means of hawsers. In spite of the enormous top loads, there was no risk of the barges tipping sideways, the girders ensuring a substantial connection. Chains had, moreover, during the preliminary work, been arranged crosswise fore and aft below the barges and fastened to the bollards on deck.

Further preparations for the cable laying were made, in spite of the heavy sea, by laying out anchors. The anchor towards Dänholm was intended eventually to allow the steamer and barges to be hauled forward by means of a steam capstan, thus paying out the cables from the drums. On account of the slow and uniform motion required in cable laying, it was not generally advisable to propel the steamer and barges by the ship's engine.

Anchors were also laid out on either side to prevent the barges from driving to leeward. On each shore were installed two beacons about 4 metres in height, destined to mark the direction of travelling, which could be controlled by hauling in or slacking out the hawsers moored sideways.

Cable laying was resumed on the following day at 6 a.m., the weather having again cleared up. As, however, the water had become so shallow that the barges touched the ground, and could only after three hours' work be got off by the steamer, the laying of the two cables 750 m. in length was not completed before three o'clock, when the two cable ends were fixed by stoppers on the third barge above referred to, which had come to anchor at 700 m. from the Rügen shore. A watertight storm-proof tent for work on the two cable sleeves was put up on this barge (fig. 4), while the empty cable drums were, towards five o'clock, taken to the shipyards. At eight o'clock in the evening, the two drums, each containing 600 m. of cable, were installed on the barges, and in half-an-hour were towed to the place where the anchored barge was waiting. After taking the ends of these two cables under the tent and fixing them there, the fitting of the sleeves could be commenced, two lanterns, each containing three 25-c.p. incandescent lamps, being installed in the tent.

On the following evening, towards nine o'clock, the cable connections were soldered and covered with insulating material. While this was allowed to cool, operations were interrupted for some hours, to be resumed on the following morning, when the iron sleeves were closed and likewise filled with the insulating compound. At two o'clock in the afternoon, the coupling sleeves were consecutively lowered

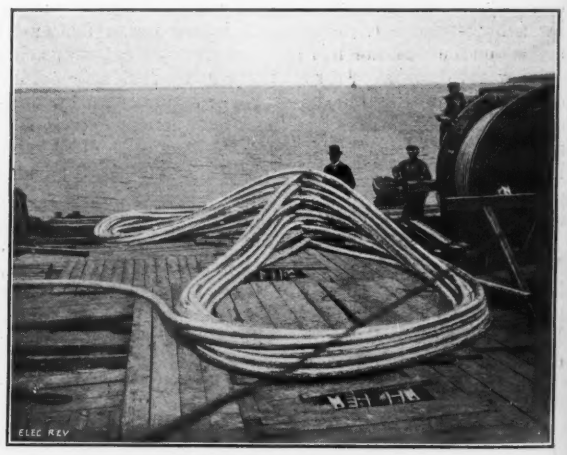


Fig. 6.—Flaking the Cable.

into the water (fig. 5). This was done by slipping ropes round the sleeve and the cable and fixing one end of each rope on board while the free end was slowly released until

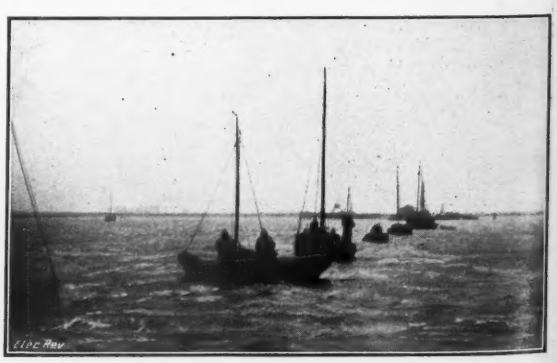


Fig. 7.—Laying the Wittow Cable.

the sleeve touched the ground at about 8 to 10 m. depth. The steamer then hauled the two barges slowly to the Dänholm shore, where it anchored at about six

o'clock, while further cable lengths were paid out and dropped into the water. The cable barges were now about 200 metres distant from the shore, the shallow water preventing any further approach.

In order to take the 300 metres of cable left on each cable-drum to the shore, the two lengths of cable had to be unwound consecutively, and arranged in 8-shaped loops on deck, thus disengaging the cable ends (fig. 6). The end of each cable thus arranged was then hauled up to the shore by means of steel hawsers and a pulley and steel capstan. Two railway rails, 10 m. long, had been buried in the ground behind a hill transversely to the direction of travelling for mooring the pulley on land. A number of rowing boats had to be slipped below the cables to reduce the friction in the muddy soil.

The laying of these cables took about six days, and insulation measurements made immediately after completing the work gave very satisfactory results.

For the purpose of laying the two short cables, each of 335 metres, between the Stralsund shore and the Isle of Dänholm, the drums were placed behind one another on a barge on separate trestles set at an angle. A winch connected with a rope made fast on the other shore was installed in the fore part of the barge, and served to haul it across. The trench dredged for the cables was about 1 metre in depth.

After laying the Stralsund-Rügen cable, two cables, each 430 m. in length, of the same design, were in November, 1912, installed from the Wittow Ferry to the Peninsula of Wittow (on the Isle of Rügen). The two cables were supplied on wooden drums, each about 2·8 metres in diameter and 1·5 m. in width, and were installed on the Rügen shore on trestles. A Stralsund steamer took up its position on the opposite shore (Wittow Peninsula) with the stern turned towards the land. From the steam capstan of this steamer a steel hawser was led across the pulley moored on the Wittow shore, and thence back through the whole width of the water, to the cable drum. The hawser was fixed to both cables so that these, during the working of the capstan, were simultaneously hauled across through the water to Wittow. Short trenches had been dredged below water from both shores to receive the cable.

On account of the considerable weight of the two cables (more than 10 tons each), and the rather muddy ground, the cables were carried on fishing boats. These were spaced about 25 m. apart, and passed, one after the other, immediately in front of the cable drums, over the cables sliding from the shore into the water. To each longitudinal side of the boat one of the cables was fixed by means of a rope; the steam capstan hauled the boat on another 25 m., to make room for the next boat, and so on.

The traffic was interrupted on the day the cables were laid (fig. 7). The cable track and the boats were lighted by night by searchlights from the steamer, thus causing any passing vessels to stop. When the work was resumed on the following morning, about 200 m. of cable was left on the drum. Considerable difficulty was experienced during the further part of the work, some of the ropes having got loose and covered up with shifting sand. When the two cable ends had at last been taken across sufficiently near to the shore, they were moored there and the ropes used to attach them to the boats were cut.

A third instance of submarine power transmission is the laying of submarine cables through the Straits of Fehmarn.

Messrs. Siemens' electricity works supply from the Lubeck power transmission station a considerable part of Holstein with electric power and light. In order to connect the Isle of Fehmarn up to this power transmission system, two 3 × 25 sq. mm. high-tension cables, designed for a working pressure of 11,000 volts, had to be laid across the straits, the two shores being about 1 km. apart. The cables were insulated with paper and lead-sheathed with armour of Z-shaped iron wire.

The two cables were, as in the case of the Stralsund installation, each supplied in two sections, the two large drums being each 3 m. in diameter, 1·80 m. in width, and, inclusive of the cable, about 20 tons in weight. The cables were taken by rail from Messrs. Siemens-Schuckert's Cable Factory at Berlin, to Kiel, in order there to be loaded on the cable boats by the crane of the *Germania* shipyards and to be shipped to Fehmarn. Two beacons having been erected on the shore of the island, a wire rope was led across the Straits and moored on the continent. This wire rope indicated the track of the cable, and was to be used for carrying the cable barges along in laying the cables.

Operations were commenced at the Fehmarn cable house, where the water was deep enough for the first barge with the two cables to approach the shore to within 20 m. distance. The cable ends were taken across the stern of the barge into the cable house. After fixing the two cable ends there, a bow anchor was lowered, and the boat moved on by heaving on the windlass, so that the cables ran out into the water. After thus paying out some hundred metres of cable, operations had to be temporarily discontinued on account of a storm coming up. The boats were anchored, and preparations were made for cutting the cables if necessary, thus allowing the boats to escape from the coast out into the sea. The cable ends would in this case have been fitted with water-tight seals and fixed to buoys in the water. Fortunately, however, the weather soon calmed down, so that the work could be resumed on the following day, when the steamer slowly towed the cable boats towards the land, the cables being paid out at the speed of 30-40 m. per minute. The two ends of the cables thus laid out were fixed by means of stoppers on the boat and got ready below a tent for connection with the two remaining cables. The boat was then firmly anchored and the second cable length from the other boat paid out in the same way as above described, after taking the cable end over to the anchored boat. Two days and two nights of almost uninterrupted work was required to complete the two connections.

In the meantime, the cables had been led into the sub-station on the mainland. The connecting sleeves were dropped to about 10 m. depth by the aid of the two boats and the mast winches which they carried.

Throughout the cable-laying operations the position of the cables was determined by means of a sextant and recorded on the chart.

British Inspection for the American Underwriters.—We are able to announce that Messrs. Heap & Digby, of 48, Westminster Palace Gardens, Victoria Street, S.W., have been appointed engineers in Great Britain to the Underwriters' Laboratories Inc., Chicago. Our readers are aware that the "National Electrical Code" of the rules and requirements of the National Board of Fire Underwriters, consisting of the British and American insurance companies, governs very closely the construction, component materials and design of all such articles as switches, fuses, rubber-covered wire, flexible cord, conduits, flexible tubing, circuit-breakers, lamp sockets, porcelain fittings, ceiling roses, motor starters, and so forth, to be used in positions where a fire hazard is involved. The "National Electrical Code" and the semi-annual "List of Electrical Fittings," issued by the Board of Fire Underwriters, in the one case prescribe the general requirements to be met, and, in the other case, give a schedule of the approved fittings. The function of the Underwriters' Laboratories is to see that these rules and requirements are carried out. For this purpose it is necessary to submit samples of the apparatus to them for approval, after which inspections are made at regular intervals to ensure that the quality of the commercial article is maintained, and in certain specified cases labels are supplied which may be attached to them as evidence to the purchasing public that such have received their approval.

Hitherto all British-made electrical fittings of the above type for use in Canada have had to be examined by the Underwriters' Laboratories' Inspectors after arrival. The arrangement which has now been made enables this to be done by Messrs. Heap and Digby before the goods leave the maker's factory, thereby giving to the British manufacturers the same facilities as those enjoyed by the American, and removing a difficulty to which His Majesty's Trade Commissioner in Canada has recently drawn attention.

Mr. Arthur C. Heap and Mr. W. Pollard Digby have each a very intimate knowledge of the British manufacturing conditions and British-made apparatus. In addition Mr. Heap has, during the last 12 months alone, paid three visits to Canada for the express purpose of studying Canadian conditions and requirements.

Messrs. Heap and Digby will be pleased to give manufacturers any information they require as to the regulations of the Board of Fire Underwriters, and supply them with copies of the National Electrical Code.

Educational Notes.—In the Faculty of Engineering at University College, the Entrance Scholarships awarded to Messrs. C. H. Avery and G. G. Dawson have been renewed for a further year, as has also the Goldsmid Scholarship that was awarded to Mr. P. L. Capper. The Archibald P. Head Medal and Prize goes to Mr. W. J. Duncan. Sixteen students have obtained Engineering Diplomas.

CONTRACTS OPEN.

(*Continued from page* 58.)

Batley.—July 15th. Steam coal (4,000 tons of pea nuts or beans) for the Corporation electricity works. Mr. S. Derwen Jones, engineer.

Belfast.—July 21st. One 3,500-ampere traction switchboard panel, for the Corporation. See "Official Notices" July 4th.

Belgium.—July 26th. The Belgian Telegraph authorities in Brussels (La Salle de la Madeleine) are inviting tenders for the following :—

Supply and laying of two cables to connect the telephone exchange in the Rue de la Paille, Brussels, with that in the Rue des Freres Cellistes, Antwerp.

Two cables to connect from Ans the existing telegraph and telephone lines between Liége-Guillemins and the telephone exchange in Verviers.

Birkenhead.—July 14th. Low-tension main cable, and india-rubber lead-covered and armoured service cable for the Corporation. See "Official Notices" June 27th.

Blackhill (Co. Durham).—July 19th. Electric light equipment, Richard Murray Hospital (dynamo, battery, switchboard, and about 200 lights) ; Mr. Ernest Caldwell, secretary of the hospital (returnable deposit of £1).

Chile.—September 13th. (1) An electric generating plant with distributing system ; (2) an electric lighting installation—both for the harbour of Valparaiso. Tenders to "Al. Sr. Secretario de la Comision, Comision de Puertos, Calle Santo Domingo No. 1,147," Santiago de Chile, where the specifications, &c., may be consulted.

Eccles.—July 21st. Mechanical stokers for four Lancashire boilers at the electricity works, Cawdor Street, Patricroft. Borough Electrical Engineer.

France.—July 30th. The French State Railway authorities (Bureaux du Service Electrique) in Paris (43, Rue de Rome) are inviting tenders for the establishment and equipment of a number of transformer stations at Rouen and Sotteville.

India.—An announcement appeared in our advertisement pages last week to the effect that the Government authorities are prepared to grant licences under the Indian Electricity Act for supply within the municipalities of Allahabad, Lucknow, and Bareilly.

London.—HACKNEY.—July 24th. Extra-H.T. ring main conduits, sub-station plant, switchgear and cranes, for the B.C. electricity department. See "Official Notices" June 20th.

H.M. OFFICE OF WORKS.—July 18th. Supply of electric cable and wire during one year from September 1st, 1913. See "Official Notices" July 4th.

L.C.C.—July 22nd. Switchgear for tramways sub-stations. See "Official Notices" to-day.

July 23rd. Electrical installation (235 points) at Tollit Street School, Mile End, E. See "Official Notices" to-day.

Newport (Mon.).—July 19th. Extra-high-tension switchgear, for the Corporation. See "Official Notices" July 4th.

New Zealand.—September 6th. Christchurch City Council. Thirteen-panel E.H.T. switchboard and accessories, for use in connection with the distribution in Christchurch of current from the Lake Coleridge hydro-electric station. Specification (10s.) from City Electrical Engineer, 153, Gloucester Street, Christchurch. Deposit £50. Can be seen at B. of T. Com. Int. Dept., London.

Nuneaton.—July 15th One line booster for the Electricity Committee. See "Official Notices" July 4th.

Portsmouth.—July 16th. Coal (not Welsh) for the Corporation electricity works. Engineer and Manager, Gunwharf Road (returnable deposit of £2 2s.)

Roscrea.—July 11th. Roscrea Bacon Factory, Ltd., invite tenders for buildings, gas engine and suction plant, dynamos, battery, switchboard, overhead feeders, mains and street lamps, for the electric lighting of the town. See "Official Notices" June 27th.

Roumania.—The municipal authorities of Constantza have just invited tenders for the concession for the supply of electrical energy for lighting purposes and for the operation of the tramway in the town and district.

July 18th.—The municipal authorities of Togu-Ocna are inviting tenders for the establishment of a central electric lighting station in the town.

Scarborough.—July 12th. Electric light installation at the Workhouse and Infirmary, for the B.G. (about 360 lights). Messrs. Tennant & Barrs, consulting engineers, Cathedral Buildings, Dean Street, Newcastle-on-Tyne (returnable deposit of £5).

Shipley.—July 22nd. Two 1,000-KW. steam turbines, two 1,000-KW. alternators, two surface condensers, and one controlling switchboard, for the U.D.C. See "Official Notices" to-day.

South Africa.—Details of the electrical machinery requirements for which the Wellington Municipality, Cape Province, are inviting tenders, are now to hand, and comprise two suction gas engines and producers, or, alternatively, superheated steam engines ; two 48-KW. three-wire dynamos ; one 10-KW. motor balancer ; and one three-wire battery booster set ; also battery and distilling plant, switchboard, poles, insulators, feeder pillars, travelling crane, meters, instruments, overhead equipment, &c. Total cost, £10,000. Specifications may be obtained on deposit of certified cheque for £10 10s., payable to the order of the Town Clerk, Wellington, from Mr. Charles G. Trevett, 70, Fletcher's Chamber's, Cape Town.—*British and South African Export Gazette.*

September 10th.—Public Works Department. Three electric bed lifts for the new hospital at Port Elizabeth. Particulars can be seen at Board of Trade Com. Int. Dept. in London, or obtained from District Engineers of Public Works Dept. at various places in South Africa.

Swindon.—July 26th. Steam coal for the electricity works of the Corporation. See "Official Notices" to-day.

Todmorden.—July 26th. 300-KW. converting plant, H.T. switchboard and cables, mechanical stokers and superheaters, for the B.C. See "Official Notices" to-day.

West Hartlepool.—July 8th. Single L.T. paper-lead cables, and pilot and telephone cables for the Tramways Department. See "Official Notices" to-day.

CLOSED.

Accrington.—The tender of Messrs. Simpson Bros., of Hapton, for a rearrangement of the electric lighting of the Market Hall, for £54, has been accepted by the Corporation.

Barrow.—The T.C. on Monday accepted the tender of Messrs. Balcke & Co., at £167, for a new interior to the No. 1 cooling tower ; the present one has been in use 13 years.

Belfast.—The Corporation has accepted the tender of the Sturtevant Engineering Co., Ltd., at £369, for supplying a wet-air filter for turbo-generators. For renewal and reconstruction of the permanent way and for permanent way depôt, the following were the tenders received :—

PERMANENT WAY.

G. Percy Trentham, Ltd.	£6,575
Dick, Kerr & Co. .. .. .. (accepted)	6,797
Grainger Bros.	6,804
Wm. Griffiths & Co.	7,190
Workman, Ltd.	7,520
J. & W. Stewart	8,856

PERMANENT WAY DEPÔT.

Wm. Dowling .. .. (accepted)	£2,066
J. & R. Thompson	2,073
Wm. Courtney	2,079
J. Hogg & Son	2,148
J. & W. Stewart	2,400

Belgium.—One Belgian and six German firms submitted tenders last week to the Belgian Post and Telegraph authorities in Brussels for the supply and laying of a quantity of telephone cable in the Antwerp district, the lowest offer being that (£5,433) of Messrs. Felten & Guilleaume, of Mulheim-am-Ruhr.

Bournemouth.—The T.C. has accepted the tender of Messrs. Walter Scott, Ltd., of Leeds, for Sandberg steel tramway rails, at £5,535.

Bradford.—The Board of Guardians has accepted the tender of Mr. Charles Bell, Bradford, for the work in connection with the electric lighting in the altered male imbecile wards, £42 10s.

The City Council has accepted the tender of Messrs. Beecroft and Wightman, Ltd., at £972, for hardwood paving blocks for the tramways department.

Brighton.—The T.C. has accepted the tender of Messrs. W. Cory & Son for coal for the electricity works at Southwick—Muirfield washed nuts (from 10,000 to 12,000 tons, with option of from 20,000 to 22,000 tons), at 16s. 3d. per ton.

Bristol.—The Docks Committee of the T.C. has accepted the tender of Messrs. Johnson & Phillips, Ltd., for 252 yd. of armoured electric cable.

Buxton.—Out of 23 quotations, the U.D.C. has accepted the tender of Messrs. Day & Ferguson for Pilsley hard slack, for the electricity works.

Canterbury.—The tender of Messrs. E. J. Philpot has been accepted for electrical illuminations at public buildings during Cricket Week, at £40.

Cape Town.—The tender of Messrs. Edward A. Shaw and Co. has been accepted for the electric lighting of the new Cathedral. The same firm have also in hand the wiring of the new Town Hall at Robertson, Cape Province.

Clacton-on-Sea.—The U.D.C., on July 2nd, accepted the tender of the Consolidated Diesel Engine Co., Ltd., for an engine, water cooler, switchboard and Crompton dynamo, at £5,438.

Colchester.—The Essex County Asylums Committee has accepted the tender of Messrs. J. & E. Hall, Ltd., of Dartford, for refrigerating plant, electric motor and insulation work at Colchester Asylum, at £349.

Doncaster.—The Electricity Committee of the T.C. has accepted the following tenders :—

Willans & Robinson, Ltd.—Turbine and condenser, £3,308.
British Westinghouse Co., Ltd.—One 350-KW. rotary converter, £1,074; and one 600-KW. rotary converter, £1,510.

Eccles.—The Electricity Committee recommends the acceptance of the following tenders for coal and coke for 12 months :—

Earl of Ellesmere.—Screened washed nuts, 14s. per ton.
Eccles Co-operative Society.—Best selected house coal, 16s. per ton.
T. Slack.—Screened ordinary quality house coal, 13s. 6d. per ton; and best gas coke, 14s. 2d. per ton.

Gillingham (Kent).—The T.C. has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for coal for the electricity works for a year—Hillhouse washed nuts at 19s. 1d. per ton, and Hillhouse washed peas at 17s. 10d.

Glasgow.—The Tramways Committee has recommended acceptance of the following tenders :—

Special trackwork.—Lorain Steel Co., and E. Allen & Co.
Ten-ton travelling crane for Whitevale sub-station.—Chambers, Scott & Co.
Teak planks.—J. Watt Torrance & Co., and Robinson Dunn & Co.
Mica.—Micanite and Insulators Co., Ltd.

The Works and Stores Sub-committee has considered offers which had been received for a condenser for the new turbine to be erected at Pinkston station for No. 4 engine there, and agreed to recommend acceptance of the offer of Messrs. Willans & Robinson for the condenser, and Messrs. John Jackson & Co. for the engine.

Hereford.—The T.C. has accepted the tender of Messrs. Walker & Co. for installing the electric light at the municipal slaughterhouse, at £24.

Heston and Isleworth.—The following tenders have been accepted by the U.D.C. for supplies of coal and coke to the electricity department :—

W. Cory & Son, Ltd.—Coleorton hard steam coal, 15s. 11d. and 16s. 11d. per ton.
Phillips & Co., Ltd.—Mapperley or Riddings bituminous nutty slack coal, 16s. 8d. per ton.
Bradbury, Son & Co., Ltd.—Gwaen-cae-Gurwen anthracite coal, 19s. 8d. per ton.
Spenser, Whatley, Ltd.—Best Derby brights house coal, 18s. 5d. per ton.
Charrington, Sells, Dale & Co.—Coke, 20s. 4d. per ton.

Lamp Contracts.—The Brimsdown Lamp Works, Ltd., have received the annual contracts for the Great Northern Railway and the Bedford Corporation; also two large orders from the Buenos Ayres and Pacific Railway.

Leeds.—The Tramways and Electricity (Works) Sub-committee has recommended the acceptance of the tender of the J. G. Brill Co. for 20 to 40 trucks for new cars, at £42 12s. 6d. each; and that of Dick, Kerr & Co., Ltd., for 20 electrical equipments, with option to take a further 20, at £234 10s. each.

The tender of Messrs. Wm. Airey & Son, for the erection of a new depôt in Sovereign Street, at £23,199, is recommended for acceptance.

London.—L.C.C.—The Council has approved of a contract with Messrs. Venner's Signs, Ltd., to supply and fix the advertisement of the Home and Colonial Stores on 1,675 of the Council's cars for 12s. 3d. a car (one end only).

The contract for machinery oil for Greenwich generating station, placed with Messrs. C. Price & Co., Ltd., is at £11 10s. per ton. The Stern Sonneborn Oil Co. will supply cylinder oil up to May, 1914, at 1s. 5½d. per gallon.

Messrs. W. Cory & Son, Ltd., have received the contract for the removal of ashes from the station for one year, at 1s. 3d. per cb. yd. Messrs. W. T. Henley's Telegraph Works Co. will supply 880 yd. of L.T. vulcanised bitumen-insulated cable for £213, and the B.I. and Helsby Cables, Ltd., 50 cwt. of D.C.C., H.C.C. wire for £222.

The following were the tenders received for the electric lighting at Elthorne Road School, Islington :—

H. J. Cash & Co., Ltd.	(accepted) £108
A. Hawkins & Sons	115
W. C. Tackley & Co., Ltd.	122
Cunningham, Ltd.	124
C. H. Cathcart & Co.	139
F. Reade & Co.	150
G. Weston & Sons, Ltd.	163

HAMMERSMITH.—The B.C. Electricity Committee has accepted the tender of the British Electric Transformer Co., Ltd., for ten 100-KW. transformers and five 50-KW. ditto. The tenders received for each transformer were as follows :—

	100-KW.	50-KW.
	£ s.	£ s.
Johnson & Phillips, Ltd.	79 0	46 17
British Electric Transformer Co., Ltd.	85 0	50 5
W. E. Burnand & Co.	87 10	54 0
Brush Electrical Engineering Co.	93 10	56 12
Foster Engineering Co., Ltd.	94 0	47 10
Ferranti, Ltd.	94 0	60 0
Electrical Engineering and Equipment Co., Ltd. ..	105 10	59 0
British Westinghouse Co.	141 0	83 10

WOOLWICH.—The B.C. has accepted the following tenders :—

W. T. Henley's Telegraph Works Co., Ltd.—Cable, £2,881.
Drew-Bear, Perks & Co., Ltd., Battersea.—Steelwork for boiler house, £2,931.
Mechan & Sons, Ltd.—Circulating water piping, £116.

SOUTHWARK.—The B.C. has accepted the tender of the Strand Building Co., at £1,715, for carrying out the works required in connection with the extension of the electric light station in Penrose Street.

STEPNEY.—The following tenders have been received by the B.C. for various supplies to the Electricity Department :—

49 STREET DISCONNECTING BOXES.

	Drawing No. 2,410. (25)	Drawing No. 2,423. (24)
Universal Electrical Manufacturing Co. .. .. .. (accepted) each	£1 6 6	£0 15 9
B. I. and Helsby Cables, Ltd.	1 18 6	1 0 6
Reason Manufacturing Co., Ltd.	2 18 6 (less 2½ per cent.)	1 19 6

MOTOR-DRIVEN BOOSTERS.

Siemens Bros. Dynamo Works, Ltd. .. (accepted)	£1,073
Bruce Peebles & Co., Ltd.	1,095
Crompton & Co., Ltd.	1,150
British Westinghouse Co., Ltd.	1,151

STORAGE BATTERY.

D.P. Battery Co., Ltd. .. .. (accepted)	£1,934
Chloride Electrical Storage Co., Ltd.	1,973
Electrical Power Storage Co., Ltd.	2,060
Do. Do. .. (alternative)	2,407
Hart Accumulator Co., Ltd.	2,122
Tudor Accumulator Co., Ltd.	2,214

ANNUAL SUPPLY OF CARBONS.

Sloan Electrical Co., Ltd. .. .. .. (accepted)	£1,043
Electrical Co., Ltd.	1,084
W. Geipel & Co.	1,101
Ditto, alternative (lower grade carbon)	988
G. Braulik	1,187
Crompton & Co., Ltd.	1,191
Siemens Bros. Dynamo Works, Ltd.	1,274
Electrical Engineering and Equipment Co., Ltd.	1,453
Ship Carbons, Ltd. .. .. (part only)	428
Union Electric Co., Ltd. .. .. (part only)	519

The following tenders have been accepted for annual supplies of coal to the Electricity Department :—

SMOKELESS WELSH AND BITUMINOUS STEAM COALS.

Bradbury, Son & Co., Ltd.—250 tons London made small Dowlais, 15s. 9d. per ton.
C. Franklin—100 tons Bwllfa, 24s. 1d. per ton; 250 tons Welsh Colliery Smalls Gored Merthyr, 18s. 6d. per ton; 600 tons Griff 2 yd. Hard large, 21s. 10d. per ton; 700 chaldrons broken coke, 12s. 11d. per chaldron; 150 chaldrons unbroken coke, 11s. 11d. per chaldron; 200 tons Charlsden Wallsend in 1-cwt. sacks, 25s. 3d. per ton; in 2-cwt. sacks, 24s. 3d. per ton; Newland Wallsend, in 1-cwt. sacks, 25s. 3d. per ton; in 2-cwt. sacks, 24s. 3d. per ton; Featherstone, in 1-cwt. sacks, 25s. 3d. per ton; and 2-cwt. sacks 24s. 3d. per ton; 25 tons Tanfield (Smith's), 24s. 3d. per ton.
Rickett, Cockerell & Co., Ltd.—200 tons London made small coal, 14s. 6d. per ton.

BITUMINOUS AND OTHER SMALL COALS.

A. Blackmore & Co.—5,000 tons Wemyss washed peas, 14s. 8d. per ton.
Cleeves & Co.—3,000 tons Cowdenbeath peas, 15s. 3d. per ton.
Dinham, Fawcus & Co., Ltd.—5,000 tons Mansfield D/S nuts, 15s. 6d. per ton.
E. Foster & Co.—4,000 tons Ibstock D/S nuts, 11s. 11d. per ton; 2,000 tons Ibstock peas, 15s. 6d. per ton.
Harris, Hardman & Co., Ltd.—3,000 tons Hillhouse peas, 15s. 3d. per ton.
J. Hudson & Co., Ltd.—5,000 tons Wemyss washed peas, 14s. 8d. per ton.

Manchester.—The Tramways Committee has accepted the tender of Messrs. Simons-Carves, Ltd., for the supply of pitch.

The Education Committee has accepted the tender of Messrs. W. P. Theerman & Co., Ltd., for an electric lighting installation at the Municipal Trades School.

The following tenders have been accepted by the Electricity Committee :—

William Gornall.—For the whole foundations and floor extensions at engine house, &c., for 15,000-KW. turbo-generator.
W. T. Henley's Te'egraph Works Co., Ltd., B.I. and Helsby Cables, Ltd., C. Macintosh & Co., Ltd., and the Electrical Engineering and Equipment Co., Ltd.—For cable.

Reigate.—The T.C. has accepted the tender of Messrs. Wilson, Carter & Pearson, Ltd., for Nixey navigation coal for the electricity works, at £1 5s. 3d. per ton.

Rotherham.—The tender of the Daimler Co., Ltd., has been accepted by the Tramways Committee, at £432, for the supply of spares and other accessories required for three motor-'buses.

St. Helens.—The T.C. has accepted the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., for a rotary converter.

Sheffield.—The following tenders have been accepted by the City Council :—

British Westinghouse Co., Ltd.—One motor-driven surface condensing plant, capable of dealing with 75,000 lb. of exhaust steam per hour, £2,647, and 10 per cent. allowance for contingencies, and with a further allowance of £100 for the old condenser.
Chatteris Engineering Works Co.—Hand travelling crane of 15 tons capacity for Kelham Island power station, £375.
J. P. Hall & Son, Ltd.—One direct-acting boiler feed pump for Kelham Island power station, £190.

Southampton.—The B. of G. has accepted the tender of Messrs. H. C. Taplin & Sons for the installation of the electric light at Shirley Warren Infirmary, at £867.

South Shields.—The Corporation has placed a contract for Wotan lamps for car-shed and office lighting, &c., and tantalum traction lamps for use on cars for 12 months, with Messrs. Siemens Bros. Dynamo Works, Ltd.

Stockport.—The Corporation has accepted the following :—

16,000 yards of 3-in. self-centring conduit, with "Stamford" joints: Doulton and Co., Ltd.
Field magnet: Lancashire Dynamo and Motor Co., Ltd.
W. T. Glover & Co., Ltd.—Twelve months' contract for cables.

Sunderland.—The T.C. on Wednesday accepted the following tenders :—

Ferranti, Ltd.—Oil switches and meters.
B.I. and Helsby Cables, Ltd.—440 yd. L.T. cable.
Phœnix Dynamo Co.—Winding motor generator.

Wakefield.—The Electricity Committee has accepted the tender of the Victoria Coal and Coke Co. for 1,000 tons of unscreened slack.

NOTES.

The £250 is still Required.—July 16th is the closing date under the terms of Mr. Byng's offer. Unless that gentleman sees his way to extend the period, the matter will, we suppose, have to close before our next issue appears. We greatly hope that the desired result will yet be secured. Will all of our readers personally consider their own position in relation to the Electrical Trades Benevolent Institution, and immediately, or between now and Wednesday next, either bring their influence to bear upon their well-to-do friends, or themselves send, the further £250 required to make up this additional £1,000 which the Fund must have, if it is to meet the increasing demands that are made upon it?

Croydon Tramway Sports.—In our last issue we referred very briefly to the sports of the Croydon Corporation Tramways Athletic Club, which took place on Wednesday, the 2nd inst., on the Brighton Railway Co.'s Athletic Club's ground, Mitcham Road. Prior to the sports, we, with several members of the technical Press, were invited to meet the Metropolitan Tramways managers and others interested in the industry over a most enjoyable and well served cold collation at Dennett's Restaurant in George Street, with that most genial of hosts and most popular of managers, Mr. T. B. Goodyer, in the chair. Those of us who lunched (!) at the Norbreck Hydro during the Blackpool Conference doubtless made mental comparisons between the fare there provided and that placed before us at Dennett's!

The Mayor of Croydon, Councillor S. Rogers, and Mr. H. E. Blain, late of West Ham, spoke in the highest terms of Mr. Goodyer's all-round excellence in everything he undertook, and we, who know him, can bear out all that was said in his praise. What we specially like about Mr. Goodyer is the keen personal interest he displays in all matters conducive to the welfare of his employés, for such friendly feeling between manager and men must result in more amicable relations between them. The capital Tramways Military Prize Band, in which he takes a special pride, is a most excellent organisation and reflects much credit upon the training of the bandmaster, Mr. W. Ellis. Only the other day, the Bishop of Southwell expressed the hope that another Carnegie would come forward and subscribe not organs, but bands, so that they could brighten life and drive out insobriety and gambling. Mr. Goodyer understands the value of a good musical combination amongst his men.

After the sports, which, towards the end of the afternoon, were somewhat marred by rain, a couple of hours were spent in the Croydon "Empire," by the kind permission of the manager and under our host's guidance. In one of the comical "turns," a "vacuum cleaner," represented it was said by a firm in Queen Victoria Street, showed up to great advantage in clearing the stage of cats, articles of ladies' attire, &c. Then the train, and home, after a most pleasurable day enjoyed alike by competitors, guests, and onlookers generally.

Production Managers' Association.—The July dinner will be held at the Holborn Restaurant to-morrow (Saturday), July 12th, at 6.45 for 7 p.m., the subject for discussion being "Scientific Management." Mr. Frank B. Gilbreth, of New York, will be the guest of the evening. The dinner will be open to anyone who is interested in production problems. Tickets, price 5s. each, can be obtained from the hon. secretary, Mr. J. W. Stannard, Queen Anne's Chambers, Westminster, S.W., or at the doors if previous notice of attendance is given.

Sheffield Electrical Workers' Wages.—According to a Sheffield newspaper, the Sheffield and district branch of the Electrical Trades Union is organising its area with a view to securing a rise of wages for electrical workers. The question was fully discussed at a meeting of the branch held in the Foresters' Hall, Sheffield, last week. Mr. T. Stewart (one of the organisers of the Union) presided, and stated that the electrical workers in Sheffield had not received an advance in wages for 13 years. At present they were paid 8½d. per hour, compared with 9d. per hour in such cities as Manchester, Liverpool and Glasgow. He urged them so to strengthen their membership that they would be in a position to approach the employers, and bring their rate of pay into line with that obtaining in the cities he had named. The speaker's remarks were endorsed by Messrs. A. Rigley (district organiser of the Painters' Society), and H. Stone (secretary of the Bricklayers' Society).

Storage Battery Litigation in the United States.—The action brought by the Electric Storage Battery Co., of New York, against the Gould Storage Battery Co., for alleged infringement of the Madden patent, a machine for making grids for secondary batteries, has just been decided in favour of the defendants by the U.S. Circuit Court of Appeals.

Scottish Electrical Contractors' Association.—The first annual general meeting of the Electrical Contractors' Association of Scotland was held at Glasgow. Mr. W. M'Whirter, president, occupied the chair. The following officials were elected for the forthcoming year:—President, Mr. Alexander Pratt, Edinburgh; vice-president, Mr. E. J. B. Lowdon, Dundee; secretary, Mr. James M. Davies, jun., chartered accountant, Glasgow; solicitor, Mr. Walter Finlay, W.S., Edinburgh.

British Trade with China.—Prof. C. A. M. Smith, of Hong-Kong University, writes as follows from St. Ermin's Hotel, Westminster, S.W., under date July 8th:—

"During the past week, one of the leading newspapers in London published an editorial note, in which was expressed great surprise at an official statement that the German trade in one of the Provinces of China had passed in value that done by the English. Such statements, however, do not cause surprise out on the Chinese coast, and I would again venture to call the attention of British manufacturers to the fact that every effort should be made by the Britishers at home to prevent these continual rumours and statements concerning the advance of our trade rivals in the Far East.

"One of the most encouraging signs of the enterprise of the British manufacturer in the Chinese market is the remarkable response which has been made to the appeal for equipment of the University of Hong-Kong, which you have generously sponsored in the columns of your journal.

"During the last few weeks, since my return to the old country, I have found among the many manufacturers to whom I have been introduced, a definite determination to do something, not only in their own trade interests, but because of the Imperial prestige.

"In the last few days, Messrs. Ferranti, Ltd, have presented a 12-panel power station switchboard complete; Messrs. Buckton, of Leeds, a 30-ton tensile testing machine; Messrs. Mather & Platt, various electrical motors, dynamos, &c., and Messrs. W. F. Stanley a large number of most valuable surveying instruments.

"I am also pleased to be able to add that I have received an intimation from the Colonial Office, that Mr. Secretary Harcourt has approved of the request from the Governor of the Colony of Hong-Kong that the Colony should make an additional contribution to the funds of the University, which is specifically allocated to pay for the salaries of two new lecturers in engineering. Thus British engineering firms will see that the Government will help them in this work if they will show themselves to be in earnest.

"There is still need for further equipment, but I feel quite confident that in a few weeks we shall be able to send the message out to the Britishers in the Far East that the whole of our engineering equipment has been presented by firms at home, and that, in addition, we have received valuable contributions for our running expenses.

"This success has been only possible because of the far-sighted policy of your Journal, and those others who have so splendidly helped in the past, and who will, we are confident, reap the reward of the work now being done. We certainly must beat our trade rivals in China.

"Yours faithfully,

"C. A. M. SMITH,

"*The Dean of the Faculty of Engineering,*
"*Hong-Kong University.*"

Electricity Supply Rifle League.—The following matches were decided during June:—

St. James's (Hocking, 94), 544; Central (Gaze, 98), 568. Ilford (Wilde L. Tufnell, 96), 564; Westminster (Horley, 98), 573. Shoreditch (Weekes, 98), 548; Brompton (Mugford, 96), 554. Shoreditch (Herbert, Ebner, 98), 578; Poplar (Robert, 92), 504. Brompton (Mugford, Beale, 98), 574; St. James's (Strange, 95), 546. Hackney (Self, Smith, 96), 556; Stepney (Mansell, Graves, Barber, 93), 531. Hackney (Smith, 96), 547; Ilford (R. Tufnell, 97), 566; Stepney (Barber, 94), 540; Central (Wells, Gaze, 96), 565. Poplar (Randall, 95), 509; Westminster (H. A. Pearman, 98), 575. Poplar (Randall, 91), 484; Brompton (Willis, Furneaux, 96), 559. The following are the positions to date:—

	Shot.	*Won.*	*Lost.*	*Points.*	*For.*	*Against.*
Shoreditch ...	8	7	1	14	4,567	4,336
Westminster ...	8	7	1	14	4,562	4,375
Ilford	8	6	2	12	4,513	4,330
Central	8	5	3	10	4,502	4,368
Brompton ...	8	5	3	10	4,465	4,345
St. James's ...	8	3	5	6	4,286	4,407
Hackney ...	8	2	6	4	4,324	4,356
Stepney	8	1	7	2	4,327	4,311
Poplar	8	0	8	0	3,761	4,479

Parliamentary.—BRIGHTON CORPORATION BILL.—The Committee on Unopposed Bills reports having passed the preamble of the Brighton Corporation Bill, and fixed the following periods of time for the repayment of loans authorised under the Bill: lands, sheds and buildings, underground cableways and cables (£9,000) 40 years; overhead line equipment, shelters, and miscellaneous equipment (£5,300) 20 years; trolley vehicles (£4,900) 10 years. The amount payable under the Rottingdean agreement for the acquisition of the Brighton and Hove Co.'s powers to construct a system of trolley vehicles from Brighton to Rottingdean is fixed to be paid 15 years from the date of the original loan.

ROYAL ASSENT.—The Royal assent has been given to the following Acts:—Crowborough District Gas and Electricity Act; Northern Counties Electricity Supply Co., Ltd., Act; Herne Bay Gas and Electricity Act; Dundee Corporation (Improvements and Tramways) Act; S. Staffs. Mond Gas (Power and Heating) Co.'s Act; Cleveland and Durham County Electric Power Act.

VARIOUS BILLS.—In the House of Lords on July 3rd the Mexborough and Swinton Tramways (Railless Traction) Bill was read a second time.

The Kelvin Memorial at Westminster Abbey.—On Tuesday next, 15th inst., at 3 p.m., the dedication will take place in Westminster Abbey of a window in memory of Lord Kelvin. The window, which is the result of action taken by engineers in the British Dominions and the United States, has been placed in the North Aisle of the Nave, in close proximity to the one erected in 1909 by civil engineers to the memory of Sir Benjamin Baker, and has been designed and made by the same artist, Mr. J. N. Comper. The chief features of the design are:—At the head of the window is a cinquefoil containing the arms of Henry V, and his badges of the Swan and Antelope, as represented on his Chantry in the Abbey. The lights contain two large figures under canopies, both lights being framed with borders, having niches holding 16 statuettes and 13 shields relating to them. In the left-hand light is the figure of King Henry V in armour (d. 1422); in the right-hand light is that of Abbot William Colchester vested as in the effigy on his tomb in the Abbey (d. 1421). Within the canopy above the King is a picture of his Coronation. The design also includes a number of other heraldic devices relating to the connection of Henry V with the Abbey. In front of the pedestals of the two large figures are tablets held by angels, containing the words:—

1. IN MEMORY OF BARON KELVIN OF LARGS.

2. ENGINEER, NATURAL PHILOSOPHER, B. 1824, D. 1907.

And beneath these again are the arms of Lord Kelvin and of Glasgow University. A special service, with music, is being arranged by the Abbey authorities, and Mr. R. Elliott-Cooper, President of the Institution of Civil Engineers, will make the formal presentation of the window on behalf of the donors.

Members of the American Engineering Societies and of the Canadian Society of Civil Engineers who may be in London at the time are invited to attend the dedication ceremony, whether they subscribed to the cost of the window or not, and they may obtain cards of admission by writing before Monday, July 14th, to the Secretary of the Institution of Civil Engineers, 12, Dartmouth Street, Westminster, S.W.

Foreign Trade in June.—During the month of June this year imports advanced in value by 15·1 per cent, exports by 22·4 per cent., and re-exports by 48·8 per cent. In the corresponding period of 1912, it must be borne in mind, the London Transport Strike was seriously affecting shipping on the Thames. From the published statistics we gather the following relating to the electrical and machinery trade:—

IMPORTS.	*Month of June.* £	*Inc. or dec.* £	*Six months, 1913.* £	*Inc. or dec.* £
Electrical goods and apparatus, excluding machinery and insulated wire	121,261	+ 30,399	764,129	+ 24,308
Machinery	595,245	+ 51,393	3,757,738	+ 330,363
EXPORTS.				
Electrical goods and apparatus, excluding machinery and insulated wire	301,454	− 20,125	2,682,811	+ 616,478
Machinery	3,233,910	+674,386	18,424,543	+2,735,357

Fatalities.—At Redruth (Cornwall) an inquest was held relative to the death of Frederick Thomas Crowe, 40 years of age, the Cornwall Electric Power Co.'s assistant manager, who died from injuries received by being thrown from a motor-cycle at East Hill, Tucking Mill. Verdict "Accidental Death."

Charles Westbury Wakelin (27), of Hulme, electrical engineer, was killed on Tuesday last week at the Partington Iron and Steel Works, Irlam. The deceased, who was employed by Messrs. Simon-Carves, Ltd., engineers, Manchester, who are erecting coke ovens at the works, was engaged on a scaffold in the ammonia house when, from some unexplained cause, he fell and alighted on the floor, 27 ft. below. In his descent his head struck an iron girder, and his skull was fractured. Verdict "Accidental Death."

An inquest was held at Weston-super-Mare regarding the death of Reginald J. Clark, an employé of the Weston Electric Lighting Co. The evidence showed that Clark, with other employés, had been engaged in removing a cable, which supplied power from the company's works to the Milton drainage scheme, from the uprights. While he was on the top rung of a ladder placed against one of the posts, the copper wire attaching the cable to the insulator broke, and the post, relieved of the strain, flew back into position, throwing deceased down. The deceased received a compound fracture of the thigh-bone, which was splintered. At the hospital the bone was wired, but septic poisoning setting in, the limb had to be amputated, deceased expiring as soon as this operation had been completed. The jury returned a verdict of "Accidental Death," and suggested that in future the tower wagon should be used for such work as deceased was employed in, and, failing this, the employé should be fastened to the post by a strap.

Edna Electric Lamp Dispute.—In the City of London Court on Tuesday, before Judge Rentoul, K.C., a claim was made by Messrs. Louis Schloss & Co., metallic-filament lamp manufacturers, 110, Cannon Street, E.C., against Mr. L. S. Anderson, electrical engineer, 15, Howden Place, Leeds, formerly of 54, Shoreham Street, Sheffield, to recover £12 4s. 6d. for Osram lamps supplied. Mr. Morley appeared for the plaintiffs. The Judge said the defendant had written to say that the plaintiffs' claim was in respect of Edna electric lamps, the bulk of which were received on February 10th from abroad. At the time when the lamps were supplied by the plaintiffs they (plaintiffs) were being prosecuted by the Osram Lamp Works, Ltd., defendant added, for infringement of patents in the manufacture and sale of the Edna lamps. On February 7th Mr. Justice Swinfen Eady, in the Chancery Division, had before him a motion to restrain the plaintiffs from infringing the patents. On March 7th the Judge granted an interim injunction of restraint in the manufacture and sale of the lamps. The injunction was ultimately granted, and an order made for the delivery up of the infringing articles. He submitted, therefore, that the lamps now sued for could not be sold by the plaintiffs, and that the plaintiffs were not entitled to payment. Further, the lamps were very defective in character, as although stated to burn an average of 1,500 hours, their average life was less than 50 burning hours. He had to replace most of those lamps with another make, at his own expense. In fact, the Edna lamps injured his lamp trade in Sheffield so badly, that he had in consequence to give up business there. Mr. Morley said that the lamps were sold long before the proceedings referred to by the defendant. Judge Rentoul said that of course what the defendant said was rubbish, and had nothing to do with the matter. Mr. Morley said that at most defendant could have raised a counterclaim, but that he had not done. Judge Rentoul said that the defendant had asked for an adjournment. If he were a solvent man he would grant it. Mr. Morley added that his clients had grave doubts as to whether they would recover. Mr. Schloss having proved his case, judgment was given for the plaintiffs for the amount claimed, with costs.

Copper.—Visible supplies at the end of June, though not decreasing so rapidly as in the early part of the year, are by no means high. Messrs. H. R. Merton's statistical circular shows stocks in England and France and afloat thereto from Chile and Australia, 28,142 tons; European stocks 39,460 tons. The decrease in English stocks during the month has been 1,291 tons. European arrivals from America have been low, and the quantity received by England and France from Spain and Portugal is exceptionally small. Chile shipments are below the average, and Australian the same. Total deliveries at 35,896 tons, are the lowest since last September, but the heavy figure of the preceding month pointed to a decrease in this. At the end of May American stocks stood at 30,122 tons, a decrease of 3,606 tons on the preceding month. The world's visible supplies were 70,309 tons, showing a loss of 7,247 tons on the figure for the end of April.

Appointments Vacant.—Assistant master in the Electrical Engineering Department of the Polytechnic, Regent Street, W. (£150); instrument maker and electrician for Hong-Kong University (£200 + £100 house allowance). See our advertisement pages to-day.

Annual Outings.—The Linolite Co. had their annual outing on Saturday last, the office and works staffs leaving Victoria Station at 6.45 a.m. for Herne Bay. The weather was favourable, and the party, after indulging in boating and swimming, lunched at Messrs. Borst's picturesque tea gardens on the Lees. In the afternoon the interesting ruins of Reculver Towers, which date back to the Roman period, were explored. Tea was served in the summer houses on the lawn of the above gardens, the party returning to London by the 8.40 p.m. train, after a most enjoyable day. Mr. R. L. Matthews, the assistant manager, was present, but, to the regret of all, Mr. A. S. E. Ackermann, the engineer to the company, was unavoidably absent, he having left a few days previously for Egypt, as already announced in our columns.

The Tunbridge Wells Corporation electricity works staff and employés, accompanied by the local wiring contractors—always a happy feature of the Tunbridge Wells festivities—went for their annual outing. Margate was visited, and the party was met there by the chief electrical engineer, Mr. R. N. Torpy, who was just returning from a visit to Ghent Exhibition. Luncheon at the Popular Restaurant was followed by some of the party with a sail in the *Moss Rose*, after which tea, the joy-wheel, and songs and speeches in the saloon on the return journey, were all parts of the programme. Mr. Torpy said how glad he was to see the contractors at their tenth outing. Other speakers were Mr. J. Bemrose, Mr. J. B. Strange and Mr. H. A. Stonham (for the contractors). Thanks were accorded to Mr. Hayden for arranging the programme.

The employés of Messrs. Page & Miles, Ltd., of Brighton and Worthing, accompanied by the chairman, Councillor J. W. Penfold; managing directors, Messrs. E. J. Page and H. J. Miles; secretary, Mr. A. C. Ganson; and works manager, Mr. J. T. Baker, held their annual outing on Saturday last. Starting from 60, Western Road, at 7 o'clock in motor coaches provided by the Brighton, Hove and Preston Omnibus Co., they proceeded to Washington, having breakfast at the Burrell Arms, after which they journeyed to the Swan Hotel, at Fittleworth, the headquarters for the day. Sports were indulged in, the prizes having been given by the directors and friends. At the dinner which followed, the toast of "The Firm" was proposed by Mr. F. Patching, and responded to by the chairman, who mentioned that a new branch of the firm was about to be started in Eastbourne. The visitors were toasted on the proposition of Mr. H. J. Miles, who mentioned that on this the twenty-third outing they numbered nearly 80. At the first outing they ever had there were 16, and out of that 16, eight were present on this occasion. This was responded to by Mr. Wilson in a very humorous speech, and the health of Mr. J. T. Baker was proposed by Mr. Lowe. After the prizes had been presented, the party returned home. The arrangements for the day were made by the works manager, Mr. J. T. Baker.

The Merthyr Electric Traction and Lighting Co. had a very successful annual outing to Parkmill, Gower, recently. They were conveyed from Merthyr to Gower in motor char-à-bancs and cars. Mr. G. J. Summerville, chairman of the company, and Mr. S. J. Clements, the secretary, were present. Mr. H. King, late traffic superintendent of the company, was presented with a testimonial by the company's employés and staff, upon his leaving Merthyr to take up his duties as traffic manager on the Aberdare new tramways.

The G.E.C. Head Office Fire Brigade held their first annual outing on July 5th, when the members, under the command of their captain, Mr. W. H. Snowden, and accompanied by their instructor, Mr. Riley (late of the Metropolitan Fire Brigade), visited Windsor. The weather was not exactly on its best behaviour, but having been trained to brave the dangers of fire, the brigade was not to be daunted by the steady downpour of water. On arrival at Windsor, a brake was chartered and visits were paid to some of the most interesting spots in Windsor Great Park and Windsor Forest. On returning to the hotel, full justice was done to an excellent repast, which was followed by an impromptu concert. After an hour or so on the river in the evening, the party wended their way homewards, having had, in spite of the rain, a very enjoyable time.

The employés of the Western Electric Co., Ltd., had their annual outing to Herne Bay on Saturday, June 28th. About 950 went to Herne Bay by the *Yarmouth Belle*, while hundreds more went by train. A sports meeting was held in the Recreation Ground, High Street, during the afternoon. Selections were played by the Western Electric Brass Band, under the direction of Mr. T. Pender. The prizes were presented by Mr. C. L. Rice.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Bolton Electricity Committee on Monday appointed MR. W. J. WOOD borough electrical engineer, in the place of Mr. A. A. Day, who has resigned through ill-health. Mr. Wood has been in the service of the Corporation since 1901, and has latterly performed Mr. Day's duties. His salary commences at £400, rising to £600 per annum.

MR. S. FORBES BOYD, of Didsbury, has been appointed assistant superintendent of the wiring and fittings department of the Sheffield municipal electricity undertaking (owing to the resignation of Mr. H. G. Bennett) at £150 per annum, rising by biennial increments of £10 to £180 per annum.

MR. F. E. SPENCER, at present station superintendent, has been appointed chief assistant electrical engineer to the Birkenhead undertaking.

The St. Helens Electricity Committee has appointed MR. W. A. JOYNSON, of St. Helens, as mechanical engineer at the electricity works.

MR. A. G. CROSS, of the Newcastle-on-Tyne Electric Supply Co., Ltd., has been appointed shift engineer at the Avonmouth substation of the Bristol Corporation electricity department, which vacancy was recently advertised.

MR. J. P. MEIKLEJOHN, who has been chief assistant engineer to the Penarth Electric Lighting Co., has been appointed managing engineer in place of Mr. H. Cameron, who has resigned on account of ill-health.

The Gillingham (Kent) Town Council has appointed MR. D. W. RITSON, recenty charge engineer at Ebbw Vale, as assistant electrical engineer.

The Morley T.C. has appointed MR. P. B. WRIGHT as engineer-in-charge at the Electricity Works.

The Crewe T.C. on July 2nd adopted the recommendation of the General Purposes Committee to increase the salary of MR. H. H. DENTON, chief electrical engineer, from £300 to £350 per annum, and that of the assistant electrical engineer, Mr. J. J. HOOLEY, from £150 to £175.

Tramway Officials.—Last Friday evening the members of the Metropolitan Association of Electric Tramways Managers entertained MR. H. E. BLAIN, their late chairman, to dinner at the Municipal and County Club, Whitehall Court, S.W., when there were present Messrs. Ullmann (East Ham), vice-chairman; Fell and Bruce (L.C.C.); Schofield (Leyton); Harvey (Ilford); Coveney (Erith); Stokes (Bexley); Murray (Walthamstow); Hammond (M.E.T.); Mason (South Met.); and Goodyer (Croydon), hon. secretary. Mr. H. England (Wakefield) was also present. Mr. Ullmann, in proposing the toast of the evening, and expressing the general regret of all present at the circumstances which had brought about Mr. Blain's severance from Metropolitan Municipal Tramways operation, and more particularly his connection with their Association, of which he was the chairman and prime founder, spoke feelingly of the many excellent qualities possessed by their guest. He stated that no tramways manager in the metropolitan area had done more to support the usefulness of the Association and the most cordial relationship of its members, than had Mr. Blain. Mr. Goodyer, in supporting the views expressed by Mr. Ullmann stated that, as hon. secretary of the Association for several years past, and also in connection with many other matters, he had been in very close touch with Mr. Blain, and would look upon that gentleman's departure as a personal loss. While congratulating him upon the excellent appointment he had secured, he stated that his new employers would find that they had gained a "real live man." Mr. Fell, Mr. Bruce, Mr. England, and others, also bore testimony to Mr. Blain's excellent abilities. Mr. Blain, in response, referred to the good work which had been accomplished from time to time by the Association, and expressed his keen appreciation of the very kindly feeling which had prompted the holding of that function, and which, he affirmed, had characterised the whole of their mutual relationship during the 10 years he had been amongst them in the area. He expressed his genuine pleasure at the good fellowship and warmth of personal friendship extended to him, and stated that he would be very sorry if any change he had made implied the breaking-away from such genial ties.

The Bolton Tramways Committee has appointed MR. J. BARNARD, who has been acting as traffic superintendent, to the post of tramways general manager, at a salary of £400, rising to £600. He has been in the employ of the Corporation 13 years.

The electricity and tramways staff at Doncaster have presented a marble clock and pair of bronzes to MR. R. COOK, of the tramway staff, on his resignation.

General.—MR. GEO. SCHULTZ, engineer and manager of the Notting Hill Electric Lighting Co., Ltd., having retired after 23 years' service, has been presented by the directors and staff with a silver salver suitably inscribed. The presentation was made by Sir William Crookes, O.M., F.R.S., the chairman of the company. MR. R. G. RAWKINS (secretary for the past 20 years) has been appointed manager and secretary, and MR. A. P. MCDOUALL (assistant to Mr. Schultz for 16 years) has been appointed chief engineer.

MR. W. LUNN, A.M.I.E.E., has resigned his position after seven years as supervising engineer for outside contracts for Messrs. Siemens Bros. & Co., Ltd., Woolwich, and sailed on July 9th to settle in San Francisco.

On Monday PROF. E. RUTHERFORD was elected a member of the Royal Institution.

On the occasion of his marriage to Miss E. M. Brookhouse, MR. HAROLD LUCKIN has been presented by the staff of Messrs. Crompton & Co., Ltd., of Chelmsford, with a canteen of cutlery.

MR. PHILIPP LAUBACH, late manager switchgear department, Electrical Engineering and Equipment Co., has now taken up the position of manager to Messrs. Morris & Lister (London), Ltd., 3 and 4, Palace Chambers, Bridge Street, Westminster, S.W.

MR. H. J. BUTTERFIELD, assistant engineer to the Oxford E.L. Co., Ltd., has resigned after 15 years' service, to join the firm of Hill, Upton & Co., electrical engineers, of George Street, Oxford. The directors and staff of the company have presented Mr. Butterfield with an inscribed gold watch, which was handed to him by Sir Henry Mance, chairman of the company, who wished the recipient every success in his new business of electrical contractor.

Obituary.—The death is announced from Heidenheim, Wurtemburg, of DR. FRIEDRICH VON VOITH, head of the firm that makes the well-known Voith turbine.

Will.—The late MR. JOHN SAXBY (Saxby & Farmer), of railway signalling fame, left £55,583.

NEW COMPANIES REGISTERED.

Delabole Electric Lighting and Supply Co., Ltd. (129,917).—This company was registered on July 3rd, with a capital of £1,500 in 5s. shares, to carry on the business indicated by the title. The subscribers (with one share each) are:—H. Spragg, High Street, Delabole, quarryman; J. D. Stacey, Pengelly, Delabole, vanman; R. Pearce, School House, Delabole, schoolmaster; S. Radcliffe, Rockhead, Delabole, baker; J. Haley, Medrose, Delabole, ex-police constable; J. Stephens, Delabole, butcher; M. J. Wells, 3, Tamar Terrace, Launceston, managing director of Old Delabole Slate Co., Ltd. Minimum cash subscription, £200. The number of directors is not to be less than three or more than seven; the first are M. J. Wells, F. L. Houghton, W. H. Hawke, Rev. K. Pollock, R. Pearce, S. Radcliffe and J. Stephens. Registered by A. J. Vere-Bass, 30, Budge Row, E.C.

Eclipse Electric Sign Co., Ltd. (129,866).—This company was registered on July 1st, with a capital of £15,000 in £1 shares, to carry on the business of manufacturers of, agents for and dealers in electrical machinery of all kinds, and to adopt an agreement with Victor Von Vangel. The subscribers (with one share each) are: C. Black, Aston Grays, Pinner, secretary; R. L. Urquhart, Tavistock Hotel, W.C., gentleman. Private company. The number of directors is not to be less than two or more than five: the subscribers are to appoint the first; qualification £100; remuneration, £100 each per annum (chairman £150). Registered office, Empire House, Piccadilly, W.

Lester B. Betts & Co., Ltd. (129,952).—This company was registered on July 4th, with a capital of £1,500 in £1 shares, to carry on the business of electrical, mechanical, constructional and consulting engineers, founders, japanners, electroplaters, contractors, iron and steel merchants, cycle dealers, &c., and to adopt an agreement with Lester B. Betts. The subscribers (with one share each) are; A. E. Robinson, 30, Whitefriars Crescent, Westcliff-on-Sea, engineer; Lester B. Betts, 92, Eccles Road, Lavender Hill, S.W., electrical engineer. Private company. The number of directors is not to be less than two or more than five: the first are A. E. Robinson and Lester B. Betts; qualification of first directors, 50 ordinary shares; of others, 100 shares. Registered by Richmond, Gilbert & Pratt, 18, Walbrook, E.C.

Jackson Electric Stove Co., Ltd. (129,825).—This company was registered on June 28th, with a capital of £10,000 in £1 shares (3,000 preference), to carry on the business of manufacturers of electrical, heating and cooking apparatus, general electrical engineers, &c., and to adopt an agreement with E. W. Brighten. The subscribers (with one share each) are:—E. W. Brighten, 4, Mitre Court, Temple, E.C., solicitor; F. H. Williams, 87, Northbrook Road, Ilford, electrical engineer. Private company. The number of directors is not to be less than three or more than five; the first are E. W. Brighten (permanent chairman) and F. H. Williams. So long as T. and J. Jackson, Ltd., hold not less than 2 000 shares they may appoint a director; qualification, £50; remuneration of chairman, £25; of other directors, £5 each per annum. Registered office, 88, Blandford Street, Baker Street, W.

Scottish Midlands Electricity Supply, Ltd. (8,716).—This company was registered in Edinburgh on June 24th, with a capital of £20,000 in £1 shares, to carry on the business of an electric light, heat and power supply company. The subscribers are:—A. H. Beatty, 66, Queen Street, E.C., contractor, 200 shares; W. S. Swinton, King's Avenue, Bromley, Kent, company secretary, 200 shares; H. L. Williams, Copthorne, Worcester Park, engineer, 200 shares; C. Don, 63, Castle Street, Edinburgh, engineer, 300 shares; T. Tauser, 3, Upper Gilmore Place, Edinburgh, clerk, 100 shares; R. F. Shepherd, 16, Charlotte Square, Edinburgh, W.S., 300 shares; I. C. A. Murray, 63, Castle Street, Edinburgh, secretary of public company, 100 shares; J. R. Little, 18, Charlotte Square, Edinburgh, secretary of public company, 300 shares. The number of directors is not to be less than two or more than four, the first are J. R. Little, C. Don and R. F. Shepherd; qualification, 100 shares. Registered office, 63, Castle Street, Edinburgh.

Galashiels and District Electric Supply Co., Ltd. 8,717).—This company was registered in Edinburgh on June 24th, with a capital of £30,000 in £1 shares, to carry on the business of an electric light, heat and power supply company. The subscribers are:—A. J. Sanderson, Knowepark, Galashiels, manufacturer, 250 shares; A. Fairgrieve, Maplehurst, Galashiels, manufacturer, 250 shares; H. Sanderson, Rylands, Galashiels, manufacturer, 250 shares; A. Brown, Maryfield, Galashiels, manufacturer, 250 shares; J. Wishart, 23, Rutland Street, Edinburgh, solicitor. 1 share; I. C. A. Murray, 63, Castle Street, Edinburgh, secretary, 1 share; T. Tauser, 63, Castle Street, Edinburgh, clerk, 1 share. The number of directors is not to be less than two or more than five; the first are G. Balfour, A. Fairgrieve, and H. Sanderson; qualification, 100 shares. Registered office, 23, Rutland Street, Edinburgh.

Autokal Syndicate, Ltd. (129,688).—Registered June 21st, by Faithfull & Owen, 58, Lombard Street, E.C. Capital, £50,000 in £1 shares (20,000 pref.). Objects: To carry on the business of engineers, manufacturers of appliances, &c., to acquire certain patents for inventions relating to calculating machines, and to adopt agreements (1) with E. R. Clark and E. R. Debenham, and (2) with the said E. R. Clarke. The signatories (with one share each) are:—W. H. Alexander, 91, Wimpole Street, W., secretary; F. Owen, 58, Lombard Street, E.C., solicitor. Private company. The first directors (to number not less than two or more than five) are E. R. Debenham and E. R. Clarke (both permanent, subject to holding 5,000 ordinary shares); remuneration as fixed by the company. Registered office, 152½, Blackfriars Road, Southwark, S.E.

S. Gillitt, Ltd. (129,743).—This company was registered on June 24th, with a capital of £10,000 in £1 shares, to take over the business carried on at Newcastle-on-Tyne, by S. Gillitt, and to carry on the business of electricians, engineers, manufacturers of, and dealers in, electrical appliances, novelties and specialities and mathematical and philosophical instruments, hardwaremen, &c. The subscribers (with one share each) are:—S. Gillitt, 1, Clifton Ville, South Gosforth, Northumberland, electrical engineer; W. H. D. Arthur, Oakland House, High West Jesmond, Newcastle-on-Tyne, gentleman. Private company. The directors are to number not less than two or more than five. S. Gillitt is one of the first: qualification, 100 shares; remuneration of first directors, £200 per annum. Solicitors, Maughan and Hall, Newcastle-on-Tyne. Registered office, 33, Great Market Street, Newcastle-on-Tyne.

CITY NOTES.

Electric Construction Co., Ltd.

THE directors report that the net profit for the year ended May 31st, 1913 (after payment of £6,903 for debenture interest, and crediting £5,000 as formerly to depreciation account), is £27,501. Adding £5,694 brought forward, the amount available for distribution is £33,194, which is to be appropriated as follows: Dividend of 7 per cent. per annum on the preference shares (whereof a moiety was paid on January 31st), £4,395; dividend of 5 per cent. per annum on the ordinary shares, £11,210; transfer to general reserve fund (which will then amount to £46,000) £10,691; balance carried forward, £6,899. The company's works have been fully employed during the past financial year, and better prices having prevailed a further improvement in profits is shown in the accounts. The orders on hand are very satisfactory. During the year £12,700 (including the £7,700 referred to in last report) of the company's 4 per cent. debenture stock has been redeemed at a discount, which has been credited to general reserve fund. The total amount of the debenture issue is now £170,000. The directors report with regret the death of Sir Irving Courtenay, Kt., who had held a seat on the board since the incorporation of the company, and who had been appointed chairman only a few months before his death. Mr. Philip Edward Beachcroft has been appointed chairman, and Mr. William Bulloch, who has been manager of the company's works for eleven years, has been elected to fill the vacancy on the board. Mr. Bulloch retires at the general meeting, and offers himself for re-election. Sir James Pender, Bart., also retires and offers himself for re-election. Representations have been made to the board that the fully-paid preference and ordinary shares of £2 each of the company should be divided into two fully-paid shares of £1 each, and notice of an extraordinary meeting, to be held at the close of the general meeting, has been given, to consider and, if thought fit, to pass the necessary resolution. It has been decided to close the financial year on March 31st in future, and the next accounts will, therefore, embrace a period of ten months only.

The annual meeting is called for July 15th at Winchester House, E.C.

Telegraph Construction and Maintenance Co., Ltd.—An interim dividend of 5 per cent. is announced.

Chile Telephone Co., Ltd.

THE report for the year ended March 31st, 1913, states that the aggregate number of subscribers at all centres at the end of the year was 12,651, as compared with 11,647 at the beginning, or a gain of 1,004 for the year. The gross revenue in Chile from all sources was:—In 1912-13, $2,836,550, an increase of $528,732; the expenditure in Chile was, in 1912-13, $1,376,415, an increase of $239,445; the net income in Chile from all sources was:—In 1912-13, $1,460,134, an increase of $289,287. The average rate of exchange for the year was 10·13d., as compared with 10·49d. in the previous year, giving a decrease for the year of 0·36d. Converted into sterling at these rates, the figures given in the preceding paragraph are:—In 1912-13, £61,623, an increase of £10,413. The liquid assets and liabilities in Chile on March 31st, 1913, were valued at 10d., the current rate of exchange on that day, as compared with 10½d. at which they were valued on the corresponding date of the previous year. The balance to the credit of the revenue account, including £3,382 brought from the previous year, is £61,771, of which £17,565 has been expended in Chile in replacements, &c., of plant and £13,904 carried to reserve. An interim dividend of 3s. per share, free of income-tax, was paid on January 15th last, and the directors now recommend a final dividend of 5s. per share, free of income-tax, leaving a balance of £3,901 to be carried forward.

Japanese Notes.—The Osaka Electric Light Co., of Osaka, reports a profit of £139,000 for the last financial half-year; it is expected that a dividend at the rate of 12 per cent. per annum will be declared. The Yokohama Electric Tramway Co. reports a profit of £40,045 for the past six months, and is declaring a dividend of 11 per cent. This company proposes to construct a light electric railway between Yokohama and Yokosuka. The Osaka Electric Lamp Co. is paying a dividend at the rate of 12 per cent. per annum for the last financial half-year.

Perth Electric Tramways, Ltd.—At an extraordinary general meeting held on 4th inst. at Oxford Court, Cannon Street, E.C., Mr. O. Wethered presiding, the shareholders passed a resolution winding up voluntarily, to enable the directors to carry out the sale of the property. The chairman congratulated the shareholders on the arrangements made. As soon as the resolution was confirmed, there would be no difficulty in at once making a distribution, probably £1 per share, the distribution of the balance of the assets following as soon as the necessary details of the liquidation are carried out. Mr. Stoneham, who seconded, said that the Government had made a good bargain, and as they had raised the money to pay for the undertaking at a little over 4 per cent., if they carried on the tramway as the company had carried it on, they would no doubt be receiving something like 10 per cent. upon their money.

Cape Town Consolidated Tramways and Land Co., Ltd.—The directors report that the profit and loss account for the year to December 31st, after charging London administration expenses, &c., shows a debit balance of £1,678, which makes the total to the debit of profit and loss account £6,306, to be carried forward. No dividend has been declared by the subsidiary companies during the past year. The Estate Co., the Cape Marine Suburbs, shows a small profit for the year of £457, and the Camps Bay Tramway Co. shows a profit of £2,973 for the same period.

Continental.—FRANCE.—A new company has just been formed at Nogent-le-Rotrou, with a capital of £10,000, and the title La Société Electrique de Nogent-le-Rotrou et Extensions, to establish a small central electric lighting station in the town.

RUSSIA.—La Société Belgo-Russe de Chemins de Fer, Tramways, et Electricité, is the name of a new company, which has just been formed in Brussels with a capital of £10,000.

GERMANY.—Messrs. Brown, Boveri & Co., of Mannheim, are declaring a dividend of 8 per cent. for the last financial year, as compared with only 5 per cent. in the preceding 12 months. The capital of the company has lately been increased from £300,000 to £450,000.

Direct United States Cable Co., Ltd.—Interim dividend, 2s. per share, less income-tax (at the rate of 4 per cent. per annum), for the quarter ending June 30th, 1913, payable July 31st.

Dublin United Tramways Co. (1896), Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum on the preference shares, and at the rate of 6 per cent. per annum, on the ordinary shares, both less income-tax, for the half-year to June 30th.

Cuban Telephone Co.—The directors have declared a dividend on the common stock of 1¼ per cent. for the quarter ending June 30th.

R. Waygood & Co., Ltd.—The directors have issued a circular to the shareholders offering them 15,000 6 per cent. preference and 15,000 ordinary shares of £1 each at par.

Anglo-American Telegraph Co., Ltd.—The board has declared an interim dividend for the quarter ended June 30th, 1913, of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income-tax.

Humphrey Pump Prospectus.—A financial daily is informed that the issue of shares by this company was considerably over-subscribed.

General Electric Co., Ltd.

THE directors' report for the year ended March 31st, 1913, shows that the net trading profits and income from investments, &c., amounted to £145,261, plus £32,050 brought forward, making a total available profit of £177,311. Debenture interest and depreciation amount to £32,543; dividend on the preference shares at the rate of 6 per cent. for the year ended March 31st, 1913, has been paid, absorbing £19,878, leaving an available balance of £124,890, which the directors recommend should be appropriated as follows:—Provision for managing director's and employés' bonus, £9,284; provision for expenses of new issue of preference shares, £10,275; provision for dividend on ordinary shares at the rate of 10 per cent. for the year, £40,000; to reserve account, £30,000; to conditional appropriation to staff benevolence, £3,000; balance to be carried forward, £32,331. The reserve account balance at March 31st, 1912, was £140,000, and the proposed appropriation of profit for 1913 as above, £30,000, gives a total reserve account of £170,000.

The directors are pleased to record a further advance in the net result of the year's trading. The company's works have been fully employed throughout the year, and further extensions are contemplated. The increase in stock is due to the continued advance in the sales and orders on hand. The investment account shows a further increase on account of the development of the company's oversea undertakings. During the year an issue of £150,000 6 per cent. cumulative preference shares has been made, the expenses of which have been dealt with in the above accounts. Mr. Fred S. Sells, who was appointed director by resolution of the board dated November 5th, 1912, being eligible, offers himself for re-election. Mr. L. G. Byng retires, and offers himself for re-election as a director.

We give below the comparable figures from the reports for the three years ended March, 1911, 1912 and 1913:—

	1911.	1912.	1913.
Net trading profit and income from investments ...	£119,146	£133,564	£145,261
Depreciation and debenture interest	32,331	32,400	32,543
Balance	95,734	113,377	144,768
Pref. dividend	12,500 (5 %)	12,500 (5 %)	19,878 (6 %)
Available balance	83,233	100,877	124,890
Managing director's and employés' bonus	7,431	8,866	9,284
Expenses of new issue of pref. shares	—	—	10,275
Staff benevolence	—	—	3,000
Ordinary dividend	19,973 (5 %)	29,960 (7½ %)	40,000 (10 %)
To reserve account	43,615	30,000	30,000
Balance carried forward ...	12,214	32,050	32,331
Reserve fund total	202,104*	140,000	170,000

* As £92,104 of this was applied towards writing down goodwill and patents, the total reserve was £110,000.

The annual meeting was held yesterday.

STOCKS AND SHARES.

Tuesday Evening.

THE settlement of the strike on the Rand provided markets with a stimulus to better prices, and, after the acute depression of the previous week, this factor was welcomed with chastened gratitude. Lively fears had been aroused that the threatened stoppage in the mines might exercise a serious effect upon the world's supply of gold, hence the Consol and other investment departments went back sharply. For the time being, the Balkans business became a back number, ignored until the settlement of the Transvaal strike sent the bears hunting for other game.

Victoria Falls Power Preference shares weakened, as shown in our previous report, and the fall nominally has not been regained, although the market is decidedly stronger than it was. The incident has shown in unmistakeable colours to what a large extent the gold mining industry of the Witwatersrandt is dependent upon electricity in its service, for what was dreaded above all else was the rioters wrecking one or more of the power stations of the Victoria Falls Co. The danger is over now, but one need not be short of Kaffir shares to recognise the danger of sporadic outbreaks before the strike affair can be considered altogether over.

Electric Supply shares remain a firm and a good market. The dozen advances secured in this department last week have been held. Westminster Ordinary and London Electric Preference have further gains of 2s. 6d. each to their credit. Bournemouth and Poole Ordinary rose to 10. The only decline in the list has taken Chelseas back to 4¾. Most of the few shares which come on offer are absorbed with ease, and the market is supported by inquiries for "cheap" shares by prospective buyers, "cheap" being held to mean bargain-counter prices, and these the holders are not accepting.

Electric Constructions remain at 23s. 9d., despite a report showing an increase of 1¼ per cent. in the dividend, raising it to 5 per cent., while the allocations are on a generous scale. The directors propose to split both Ordinary and Preference capital into shares of £1 each; at present the nominal value is £2, and no doubt the suggestion will meet with cordial support from proprietors.

Home Railway stocks are a dull and spiritless market. Owing to the new arrangement whereby the companies will not issue half-yearly reports nor hold half-yearly meetings, the attention usually directed to Home Rails at this season of the year is almost entirely lacking. Nobody takes any interest in the stocks; it is generally supposed that the interim dividends to be declared this month will be much about the same as those of a year ago. The old undergrounds are depressed, Districts being down ¾ and Metropolitans ½. Underground Electric Railways £10 shares are ⅛ lower; the 1s. shares keep about 9s. London and Suburban 4½ per cent. Debenture stock has slumped several points. London United Tramways 4 per cent. Debenture reacted to 61. British Electric Tractions are weak, the 6 per cent. Preferred shedding 30s. to 9, the Deferred dropping back to 4½.

The telegraph department is none too lively. A tip has been revived to buy West India and Panama Ordinary, but it had no effect upon the price of the shares, and with markets in cautious mood as a whole, there is not much inducement to touch speculative issues. Western Telegraphs are ⅛ lower, as are also Globe Ordinary, Chili Telephones and Eastern Extensions. Orientals went a little better, on the advance in the dividend. Rumours drift across from New York to the effect that the Telephone merger is to be attacked as a combination in restraint of trade, but they exercise more effect upon the railroad than upon any other market. National Telephone Deferred rose to 27, to react to 26¼. It is thought that the final adjustment of the award given last week will result in the proprietors receiving anything between 25 and 27 per cent. They have already been paid, of course, 75 per cent. Great has been the fall from the exuberant optimism of the prophecies current this time last year, when 180 was predicted to be the break-up value of the Company's stock.

Marconis have been clinging closely to the neighbourhood of 3¾. The Government acquiesence in the cancellation of the contract was read rather as a bull point. Hope looks for another contract to be entered into on terms more favourable to the company. The amazing political bitterness imported into the recent investigation is still sufficiently strong to render it tolerably certain that the terms of any fresh agreement will be keenly scrutinised—to put it mildly.

Affairs in Mexico are in a very unsettled condition; every mail and every returned traveller bring news the reverse of pleasant concerning the conditions now prevailing. Mexican Light and Power Common shares have fallen 2½, the Preference 3 points. Mexico Trams lost 4, and the 6 per cent. Bonds dropped 1. To deal with any degree of freedom in the Latin-Canadian securities becomes a matter of increasing difficulty. Rio Tramway Bonds are 3 lower, but Sao Paulo Bonds, at par, show a gain of 2½. British Columbia Electric Railway stocks are still on the mend, the Preferred Ordinary rising 3, and the Preference 2½. Brazilian Traction fell 1½ to 86, in sympathy with the depression which overshadows a number of Brazilian issues because of the long-continued fall in the price of rubber.

The rubber market's recent spurt of strength possessed no staying power, and prices have given way materially. Much disappointment has been caused by the dwindling of the price of the product, and by some of the latest dividend declarations. The public are doing little in the market, and the "bears"—of whom there are battalions—have matters all their own way at the present time.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Bath	June 25	4,577	+ 831	26	22,172	+ 340	..	..
Blackpool-Fleetw'd	„ 18	3,152	+ 268	25	13,308	+ 893	8	..
Bristol	„ 27	33,545	+4,339	..	189,181	+19,712	30·5	..
‡Brit. Elec. Trac. Co.	„ 27	106,966	+9,267	26	618,666	+38,015	..	..
Chatham and Dist.	„ 26	3,906	+ 408	25	22,070	+ 941	14·98	..
Cork	„ 26	2,161	+ 32	25	11,986	— 197	9·89	..
Dublin	„ 27	26,353	+1,931	..	148,142	+ 2,074	54·25	..
Hastings	„ 26	4,187	+ 157	..	..	+ 1,150	19·3	..
Lancashire United	„ 25	6,282	+ 657	25	36,613	+ 3,614	39	..
Llandudno-Col. Bay	„ 27	1,401	+ 18	30	6,861	+ 726	6·5	..
London United ..	„ 27	28,965	+1,824	..	154,436	— 2,293	..	..
Tyneside	„ 25	3,329	+ 344	26	13,672	+ 760	11	..
Anglo-Argentine ..	July 1	220,409	+22,925	..	1,451,781	+120,639	..	..
Auckland	June 6	20,007	+1,828	48	240,980	+31,993	24·36	1·05
Bombay (B.E.T.) ..	May 30	12,827	+1,017	24	68,505	+ 2,755	..	..
Brisbane	May	26,560	+ 3,710	21	125,910	+39,906	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	June 30	16,513	+ 534	..	..	..	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..	..
Kalgoorlie, W.A. ..	May	3,059	..	21	14,372	..	26·5	..
Lisbon	..	..	..	..	..	..	..	..
†Madras	June 30	8,894	+ 266	..	21,277	+ 1,168	15·25	1
Montevideo ..	June	28,820	+2,428	31	228,427	+20,005	..	..
Cen. London Rly.	June 28	19,705	+ 482	26	133,243	+12,431	6·78	·4
City & S. Lon. Rly.	„ 28	10,043	—1,510	26	73,983	— 7,652	7·26	..
Dublin-Lucan Rly.	„ 27	832	+ 125	26	8,601	+ 87	7	..
G.N. and City Rly.	„ 28	5,335	— 809	26	37,363	— 5,125	3·5	..
L'pool Overh'd Rly.	„ 29	7,114	+ 695	26	42,736	+ 2,782	6·6	..
London Elec. Ry. Co.	„ 28	52,880	— 690	26	369,280	+ 3,295	21·21	..
Mersey Railway ..	„ 28	5,746	+ 444	26	53,169	+ 3,644	4·5	..
Metropolitan Rly.	„ 29	7,476	— 712	26	484,703	+ 3,084	25·71	..
Met. District Rly.	„ 28	53,059	+1,472	26	342,686	+13,681	25	..

* Compared with the corresponding period of 1912.
† Two weeks only.
‡ Includes horse, steam and other receipts.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 8th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bournemouth & Poole, Ord. ..	10	5½	6	9⅛ — 10⅛	+ ⅛	5 14 3
Do. 4½ % Pref.	10	4½	4½	8⅞ — 9⅞	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10⅜ — 10⅝	..	5 12 11
Do. 4½ % Deb. Stock	Stock	4½	4½	94 — 96 xd	..	4 13 9
Brompton & Kensington, Ord. ..	5	10	10	8⅜ — 8½	..	5 9 7
Do. 7 % Cum. Pref.	5	7	7	8⅛ — 8⅜	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4⅛ — 4⅜	..	5 5 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8½ — 4 xd	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4⅛ — 5	— ⅛	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	94 — 97 xd	..	4 12 9
City of London, Ord.	10	8	9	15 — 16½	..	5 9 1
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	113½ — 117½ xd	..	4 5 1
Do. 4½ % Second Deb. ..	100	4½	4½	98 —100 xd	..	4 10 0
County of London, Ord. ..	10	6	6	10½ — 11	..	5 9 1
Do. 6 % Pref.	10	6	6	11¼ — 11⅝	..	5 2 2
Do. 4½ % Deb.	Stock	4½	4½	102 —104 xd	..	4 6 7
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	Nil	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	3	4⅛ — 4½	..	3 6 8
Do. 6% Non-Cum. Pref. ..	5	..	..	1⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 8
Folkestone	5	6	6	4⅛ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅛ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	90 — 92	..	4 17 10
Hove	5	9	9†	7½ — 7⅞	..	5 16 2

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 8th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Kensington & Knightsbridge, Ord	5	9	8†	7⅛ — 7⅞	..	5 16 2
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	3	2½	2⅝	1⅛ — 1⅜	..	4 7 9
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	+ ⅛	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	88 — 91	..	4 8 0
Metropolitan	5	4	4†	8⅛ — 8⅜	..	5 10 4
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜ xd	..	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99 xd	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	73½ — 81½ xd	..	4 6 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9½ — 10½ xd	..	5 14 3
Oxford	5	7½	6†	5⅞ — 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10†	8¾ — 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6⅜ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	82½ — 85½ xd	..	4 1 10
South London, Ord.	4	6	6	2⅜ — 3½	..	7 7 8
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99 xd	..	5 1 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 1/16 — 1 3/16	..	5 17 11
Do. 4½ % First Deb. Stock ..	100	4½	4½	86 — 90	..	4 10 6
Urban, Ord.	£3	Nil	Nil	⅜ — ⅝	..	..
Do. 5 % Cum. Pref.	5	2	3	2⅜ — 2⅞	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Westminster, Ord.	5	10	10	8 — 8½	+ ⅛	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5⅛ xd	..	4 7 10

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5 — 5⅛	..	5 14 3
Calcutta, Ord.	5	8½	8½	7 — 7⅜	+ ⅛	5 13 4
Do. 5 % Pref.	5	5	5	4⅜ — 5⅛	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	91 — 93 xd	..	5 7 6
Canadian Gen. El. Com. ..	$100	7	7	108 —112 xd	..	6 5 0
Do. 7 % Pref.	$100	7	7	118 —123	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	3	5	3/16 — 4/16	..	6 8 1
Do. 5 % Deb.	100	5	5	[9½ — 95½	..	5–4 9
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	6	6	90 — 92 xd	..	6 10 5
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92 — 94	..	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/16 — 5/16	..	Nil
Do. 6 % Pref.	1	6	6	14/16 — 15/16	..	9 12 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	99 —101 xd	..	4 19 0
Madras, Ord.	5	Nil	..	1¼ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105 xd	..	4 15 3
Mexican Ell. Lt., 5 % 1st M. Bds.	..	5	5	74 — 77 xd	—2½	6 9 10
Mexican Lt. & Power, Common	$100	4	4†	64 — 67	—3	5 19 5
Do. 7 % Cum. Pref.	$100	7	7	96 —100	..	7 0 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	87 — 90	..	5 11 1

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	78 — 81	..	6 3 5
Montreal, Lt., H. and Power ..	$100	8	9†	210 —220	..	4 1 10
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	10	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½ xd	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital ..	$100	5	5½	126 —130	..	4 0 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	104½ —106½ xd	..	4 14 0
Do. 4½ % Per. Deb.	Stock	4½	4½	98 —100	..	4 10 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92½ — 92½ xd	..	5 8 1
Victoria Falls Power, Pref. ..	1	11 7/16d.	17 3/16d.	1/16 — 1/16 xd	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 —108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	93½ — 96⅛ xd	..	5 4 9
American Telep. & Teleg., Cap.	$100	8	8	129 —132 xd	..	6 1 3
Do. Collat. Trust	$1000	4	4	89 — 91 xd	..	4 8 0
Anglo-American Telegraph ..	Stock	3	3	61 — 64	..	4 13 9
Do. 6 % Pref.	Do.	6	6	108¼ —109¼	..	5 9 10
Do. Def.	Do.	80/-	30/-	28½ — 29½	..	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	104 —106	..	4 15 3
Chili Telephone	5	7	8	7 1/16 — 7 1/16	— ⅛	5 2 5
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	83 — 85 xd	..	4 13 7
Cuba Telegraph	10	6	6	8½ — 9½	..	6 6 4
Do. 10 % Pref.	10	10	10	15½ — 16⅜	..	5 19 4
Direct Spanish Telegraph, Ord.	5	4	4†	8¼ — 8⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6¼ — 7¼	..	6 12 0
Direct United States Cable ..	10	5	4	6 — 6⅜	..	6 3 1
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100 xd	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	127 —130	—1	5 7 8
Do. 3½ % Pref. Stock.	Do.	3½	3½	74 — 76	..	4 12 1
Do. 4 % Mort. Deb.	Do.	4	4	90½ — 92½	..	4 8 5
Eastern Extension	10	7	7	12⅝ — 12⅞	— ⅛	..
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98½ —100½	..	3 11 7
Globe Telegraph and Trust ..	10	6	6†	10⅝ — 11⅛	— ⅛	5 8 9
Do. 6 % Pref.	10	6	6	12⅛ — 12⅝ xd	..	4 15 1
Great Northern Telegraph ..	10	18	20	30 — 32 xd	..	6 5 0
Indo-European Telegraph ..	25	13	13	55 — 57	..	5 14 0
Mackay Companies Common ..	$100	5	5	80 — 83	..	6 0 6
Do. 4 % Cum. Pref.	$100	4	4	67 — 70	..	5 14 4
Marconi's Wireless Telegraph	1	20	..	3⅝ — 3⅞	— 1/16	5 6 8
Do. 7.% Cum. Partic. Pref.	1	17	..	3 — 3⅛	..	5 4 7

Monte Video Telephone, Ord. ..	1	6	6†	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	1	5	5	¾ — ⅞	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	57 — 98	..	4 11 10
Oriental Telep. and Elec. ..	1	8	10	1 31/32 — 1 33/32	+ 1/32	5 8 6
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1⅛	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87 — 89 xd	..	4 10 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	95 — 97 xd	..	4 2 6
Reuter's	10	10	10	9 — 10	— ½	10 0 0
Submarine Cables Trust ..	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	94½ — 96½ xd	..	4 13 3
United River Plate Telephone	5	3	3†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5⅓ xd	..	4 11 0
West Coast of America	2½	2½	..	1 3/16 — 1 1/16	..	4 3 4
Do. 4 % Debs., 1 to £500 guar. by Bras. Sub. Tel.	100	4	4	93 — 96 xd	..	4 1 8
West India and Panama Teleg.	10	1½	1½	2¼ — 2⅜	..	4 10 11
Do. 6 % Cum. 1st Pref. ..	10	6	6	9⅝ — 10	..	6 0 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	93 —101 xd	..	4 19 0
Western Telegraph, Ltd. ..	10	7	7†	12⅝ — 13⅛	— ⅛	5 6 8
Do. 4 % Deb.	Stock	4	4	90½ — 92½	..	4 6 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	90 — 93	..	4 16 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 3s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 8th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	33/64 — 35/64 xd	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	8 — 10	−1½	..
Do. Do. Deferred	100	..	..	3½ — 5½	−1	..
Do. Do. 6 % Cum. Pr'f	100	6	6	73 — 81	−1	7 8 2
Do. 7 % Non-Cum. Pr'f.	100	..	3	38 — 41	−1	7 6 4
Do. 5 % Perp. Deb.	100	5	5	89 — 93	..	5 7 6
Do. 4½ % 2nd Deb.	100	4½	4½	73 — 77	..	5 17 0
Central London Railway, Ord.	100	3	3	77 — 79	..	5 1 3
Do. Pref.	100	4	4	80 — 82	..	4 17 7
Do. Def.	100	2	2	76 — 78	..	5 2 7
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 8
City & S. London, 5 % Pref., 1891	100	5	5	101 —103	..	4 17 1
Do. Do. 1896	100	5	5	100 —102	..	4 18 0
Do. Do. 1901	100	5	5	99 —102	..	4 18 0
Do. Do. 1903	100	5	5	99 —102	..	4 18 0
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Great Northern & City, Pr'f. Ord	10	Nil	Nil	1⅞ — 2⅛	..	Nil
Hastings Trams, 6 % Pref.	1	6	6†	1/32 — 3/32	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	63 — 73	..	6 8 3
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅛ — 2⅜	..	4 15 3
Do. 4 % Deb.	100	4	4	73 — 73	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	76 — 78	..	6 8 2
London and Suburban, Ord.	1	..	..	3/32 — 1/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	..	7/32 — 29/32	..	..
Do. Do. 4½ % 1st. Deb.	100	..	4½	70 — 75 xd	−4½	6 0 0
London Elec. Railw'ys, 4 % Deb.	100		*	91 — 93		4 6 0
London United Trams, 4 % Deb.	100	4	4	59 — 63	−1	6 7 0

NAME	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 8th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Metropolitan Railway Consol.	100	1⅞	1⅞	45⅞ — 46¼	— ½	3 10 3
Do. Surplus Lands	100	2⅛	2⅛	61 — 63	..	4 7 4
Do. 3½ % Deb.	100	3½	3½	56 — 57	..	4 0 6
Do. 3½ % Pref.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Con. Pref.	100	3½	3½	78 — 80	−1	4 6 5
Metropolitan District Ord.	100	Nil	Nil	32½ — 33	−1¼	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 85	..	5 5 11
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 10 11
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 88	−1	5 2 3
Do. 5 % Deb.	100	5	5	91½ — 94½	..	5 5 10
Potteries, Ord.	1	4½	..	5/32 — 7/32	..	..
Do. 5 % Pref.	1	6	5	15/64 — 17/64	..	7 5 6
Do. 4½ % Deb.	100	4	4½	82 — 85	..	5 6 0
South Metro. Trams, 6 % Pref.	1	..	..	3/32 — 5/32	..	8 0 0
Do. 4 % Deb.	100	..	4	63 — 68	..	5 17 8
Underground Elec. Railways	10	..	..	3⅜ — 3⅝	— ⅛	Nil
Do. "A"	1/-	4½	..	7/16 — 9/16	..	Nil
Do. 6% First Cum. Inc. Deb.	100	1½	6	108 —110	..	5 9 1
Do. 4½ % Bonds	100	Nil	4½	96 — 98	..	4 11 10
Do. 6 % Income	100	3	6†	89 — 90	..	6 13 4
Yorkshire (West Riding), Ord.	5	..	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	5	..	3†	3 7/32 — 3 13/32	..	3 18 8
Do. 4½ % Deb.	100	4½	4½	81 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅜ — 5 xd		5 10 0
Do. 2nd Pref.	5	5½	5½	4 5/16 — 4 9/16 xd	— ⅛	6 0 7
Do. 4 % Deb.	100	4	4	90¼ — 92½ xd	..	4 6 6
Do. 4½ % Deb.	100	4½	4½	94½ — 96½ xd	..	4 13 3
Do. 5 % Deb.	100	5	5	95½ — 97½	..	5 2 6
Auckland Trams, 5 % Deb.	100	5	5	99 —101 xd	..	4 19 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96 xd	..	4 18 9
Do. 5 % 2nd Deb.	100	5	5	95 — 97 xd	− 2	5 3 1
Brazilian Traction Light and Power	$100	..	6†	£5 —£7	−1½	6 17 11
Brisbane Trams Invt., Ord.	5	8	8	6⅞ — 7⅜	..	5 8 6
Do. 5 % Pref.	5	5	5	4⅜ — 5⅛	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	97 —100 xd	..	4 10 0
B. Columbia Elec. Rly., Def.	100	8	8†	121 —126	+1	6 7 0
Do. Pref. Ord.	100	6	6	109 —114	+3	5 5 3
Do. 5 % Pref.	100	5	5	103 —106	+2½	4 14 4
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —102	..	4 8 8
Do. 4½ % Con. Deb.	100	4½	4½	95 — 97	+ ½	4 7 8
Calcutta Trams, Ord.	5	7	5†	5⅝ — 6⅛	..	5 14 3
Do. 5 % Pref.	5	5	5	4⅞ — 5 1/16 xd	..	4 18 9
Do. 4½ % Deb.	100	4½	4½	95½ — 98½ xd	..	4 11 5
Cape Electric Trams	1	2½	5	1 1/16 — 1 3/16	..	6 3 1
City Buenos Aires Trams (1904)	5	5	5†	6½ — 5/8	..	4 10 11
Do. 4 % Deb.	100	4	4	£2 — £7 xd	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	97 —101	..	4 19 0
Kalgoorlie Elec. Trams	1	Nil	..	7/16 — 9/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	6	8	25 — 35	..	..
La Plata Elec. Trms, Ord.	1	Nil	..	3/32 — 5/32	..	
Do. Pref.	1	6	..	29/32 — 1 3/32	..	5 16 6
Lisbon Elec. Trams, Ord.	1	6	4½d.	1 3/32 — 1 5/32	..	4 9 8
Do. 6 % Pref.	1	6	6	1 — 1⅛ xd	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 96 xd	+1½	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	..	6	4¾ — 5½	..	5 17 1
" Elec. Tr. (1904), Deb.	100	5	5	101 —103 xd	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	90 — 93	..	5 7 6
Manila Elec. R. and Lig., Bonds	$1000	5	5	98½ —100½	..	4 19 6
Mexico Trams Com.	$100	7	7†	9⅛ — 93	—4	7 10 6
Do. Gen. Con. 5 % Bonds	..	5	5	89 — 92	..	5 8 8
Do. 6 % Bonds	100	6	6	91 — 94	−1	6 7 8
Para Elec. Rlys. & Lt., Ord.	5	10	10	6⅝ — 7⅛	..	7 0 4
Do. 6 % Pref.	5	6	6	4½ — 5	..	6 0 0
Do. 5 % 1st Deb.	100	5	5	98 —100	..	5 0 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5⅓	1⅛ — 1⅜	..	4 0 0
Do. 5 % 1st. Deb.	100	5	5	102½ —105¼ xd	..	4 14 9
Rangoon El. Tr. & Sup., Pref.	5	6	6	6¼ — 6⅝ xd	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97 xd	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	96 — 98	—3	5 2 0
Do. 5 % Mort. Bonds	100	5	5	91 — 93	..	5 7 8
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	99 — 101 xd	+2½	4 19 9
Singapore Trams, 5 % Deb.	100	5	5	83½ — 87½	..	5 14 3
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video	5	7	7	4⅜ — 4⅞ xd	..	7 8 7
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛ xd	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 — 99	..	5 1 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ 101½	..	4 8 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	3/32 — 7/32	..	6 17 2
Do. 6 % Pref.	1	6	6	3/32 — 7/32	..	6 17 2
Babcock & Wilcox	1	28	16	21/32 — 8 1/16	..	5 4 5
Do. Pref.	1	6	6	1½ — 1⅝	..	4 7 3
British Aluminium, Ord.	1	Nil	..	7/32 — 1	..	..
Do. 6 % Cum. Pref.	1	Nil	6	3/32 — 7/32	..	5 17 2
Do. 5 % Prior Lien Debs.	100	5	5	91 — 94	— 2	5 4 2
Do. Deb. Stk.	100	5	5	83 — 86	..	5 16 3
B.I. & Helsby Cables	5	10	10	7⅞ — 8	..	6 5 0
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	99 —102 xd	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	97 — 99	..	4 11 0
British Westinghouse, Pref.	8	Nil	Nil	3/16 — 1/2	..	Nil
Do. Deb.	100	4	4	65 — 69 xd	..	5 16 0
Do. 6 % Prior Lien	100	6	6	99 —102	..	5 17 8
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½ xd	..	6 12 5
Do. 4½ % Deb	100	4½	4½	88 — 43	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	23 — 27 xd	..	16 13 4
Callender's Cable	5	15	15	10⅜ — 11½	..	6 10 5
Do. Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. Deb.	100	4½	4½	57 —100	—1	4 10 0
Castner-Kellner	1	20	20	38 — 38	..	5 6 8
Do. Deb.	100	4½	4½	103 —106	..	4 4 11
Crompton & Co.	5	Nil	..	0 — ¼	..	Nil
Do. Deb.	100	5	5	54½ — 59½	—2½	8 8 0
Dick, Kerr	1	5	Nil	3/16 — 5/16	..	..
Do. Pref.	1	6	6	3/16 — 5/16	..	7 13 10
Edison & Swan, A, £3 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1/32 — 1/16	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62 xd	..	6 9 1
Do. 5 % Second Deb.	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	8½	5	1 1/16 — 1 1/8	..	7 12 5
Do. Pref.	2	7	7	1 15/16 — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7⅛ — 8	..	8 5 8
Do. Deb.	100	5	6	92 — 94	..	5 4 2
General Electric, 6% Pref.	10	5	6	9⅜ — 10⅛ xd	..	5 14 3
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	15	12 — 12¾	..	5 17 8
Do. Pref.	5	4½	4½	4⅜ — 5	..	4 10 0
Do. Deb.	100	4½	4½	99½ —101½	..	4 8 8
India-Rubber, G. & T.	10	..	7½	11 — 12 xd	..	6 5 0
Do. Pref.	10	5	5	9 — 10 xd	..	5 0 0
Telegraph Construction	12	17½	20	35 — 37	..	6 9 10
Do. Deb.	100	4	4	95 — 97 xd	..	4 2 6
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	1/8 — 3/8	..	Nil
Do. Deb.	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

Bank rate of Discount 4½ per cent., April 17th, 1913.

THE I.M.E.A. CONVENTION, 1913.

(*Concluded from page* 36.)

THE annual general meeting of the Association was held on June 20th, when the business of electing a President and certain members of Council for the ensuing year was proceeded with. This resulted as follows :—

President.—*R. A. Chattock, Birmingham.
Senior vice-President.—*H. Richardson, Dundee.
Junior vice-President.—*Alex. Cramb, Croydon.
Council : Engineer Members.—*F. Ayton, Ipswich ; *S. E. Fedden, Sheffield ; C. Furness, Blackpool ; S. L. Pearce, Manchester ; *Thos. Roles, Bradford ; A. H. Seabrook, Marylebone ; S. J. Watson, Bury ; *Wm. Wyld, Hampstead.
Councillor Members.—Alderman Bruce, Sunderland ; Councillor Gibson, Wolverhampton ; *Alderman Sinclair, Swansea ; Alderman J. P. Smith, Barrow ; *Bailie Willock, Glasgow ; *Councillor Ellaway, Birmingham.
Hon. Solicitor.—*Alderman Pearson, Bristol.
Hon. Treasurer.—*J. E. Edgcome, Kingston-on-Thames.
Hon. Secretary.—*H. Faraday Proctor, Bristol.

*Elected or re-elected.

The report shows that the membership now stands at 386, an increase of six on the previous year's total. The Council have further considered the question of establishing a statistical bureau, but are of opinion that both in the matter of expense and prospective support, this would not be justified. They urged members to continue the present system of filing information with the secretary. The Editing Committee's report refers to the various papers received for the Convention, which included one on "Reliability of the Total Costs per Unit Sold," by Mr. A. M. Reid, chief accountant, Dundee Corporation, which will take the form of a contribution to the proceedings.

The Finance Committee's report shows that there was a slight falling off in the income from subscriptions due to fluctuations in the membership, but there was a very considerable increase in the income from "proceedings," and the Convention showed a profit. The liabilities decreased, and there was a total surplus of assets of £721. The outstanding subscriptions were only £25, part of which had since been received. The invested funds had been increased by £100, and now stood at £600 at cost, and there was a cash balance of £116.

The Council were approached by the Electric Supply Publicity Committee with a view to getting some of the larger municipalities to financially support a scheme for an extension of the Committee's proposals on a large scale. The report says the difficulty was, and is, that many local authorities are at present debarred from spending money on publicity and other similar objects, and until the I.M.E.A. Bill is passed, the electrical industry will continue to be hampered, and to be unable to compete with other industries in regard to developing its resources.

The Council have decided in favour of marking metal-filament lamps with their rated consumption in watts.

The Parliamentary Committee's report is a long one, and naturally refers in the first place to the Association's Electric Lighting Bill and the Sheffield Bill, both of which our readers have been fully informed on.

Negotiations are proceeding between the I.M.E.A. and B.E.A.M.A. with a view to standardising conditions of contract as between purchaser and contractor. So far no agreement had been reached. The Council apparently declined to ask the L.G.B. to extend the term of meter loans to 10 or 15 years. They succeeded generally in inducing members not to publish the prices of municipal tenders in the technical journals.

At the wish of the Institution of Electrical Engineers the feeling of the Council of the Association regarding closer relationship between the two bodies and the holding of annual joint conferences in place of the I.M.E.A. annual conventions was ascertained. The result of a communication to members of the Council was that the majority were averse to the proposal in principle though several saw no objection to an occasional joint conference. The opinion was expressed that the interests of the two bodies were entirely different and distinctly opposed in some instances. After due consideration it was agreed that while there was a general feeling in favour of co-operation under special circumstances, the Council did not consider it to be feasible to hold joint conventions.

As regards the constitution of the Council, the Council have given very careful consideration to the wishes of the members as expressed at the last annual general meeting, and the consensus of opinion was to the effect that some alteration of the constitution of the Council was advisable ; that the representation of the Association upon the Council should not be upon a proportionate basis ; that a change was desirable in the present method of election of the Council ; and that the Institution of Electrical Engineers' method of nomination and election should be adopted subject to certain modifications. They accordingly recommend that the number of ordinary members of the Council be increased from 14 to 15 by the addition of one engineer member, and that one-third of the ordinary members of the Council, that is, three engineer members and two municipal representatives, shall retire annually. They also recommend that the retiring past president shall not be eligible for re-election as an ordinary member of the Council until after the expiration of one year.

The Council consider that the method suggested of nomination and election will, with certain modifications, be suitable for adoption by the Association. They accordingly recommended that the method of election of the members of the Executive Council be revised in accordance with the foregoing suggestions.

A brief discussion took place on the report.

MR. BELL (Hull) urged that the Association should adopt means to save its members from the labour involved in answering numerous requests for information, and Mr. Faraday Proctor intimated that the expense stood in the way, at any rate until the Bill was passed.

In response to a suggestion by MR. WATSON (Bury) it was unanimously agreed to elect Mr. C. E. C. Shawfield as an hon. member of the Association.

MR. W. C. P. TAPPER (Stepney) introduced the question of expenditure on publicity, advertising, &c., which he urged should be properly organised on recognised lines, as in the case of the gas undertakings.

MR. ALEX. CRAMB (Croydon), a member of the Publicity Committee, said there was no way at present of meeting this expenditure. He understood that the Commercial Gas Association were trying to get the L.G.B. not to surcharge such expenditure in the case of municipal gas undertakings, and if they were successful, municipal electrical undertakings would be entitled to spend money similarly without hindrance.

ALD. PEARSON voiced the legal view, being of opinion that an authority whose accounts were audited could not make such expenditure without fear of surcharge, while Mr. Shaw (Ilford) said his authority was subject to audit, and the L.G.B. raised no objection to such expenditure by his department, providing something was shown for it. Mr. Shaw further asked that a short report of the proceedings of the National Association of L.G. Officers, to which the Association has appointed delegates, should be placed before members of the I.M.E.A.

MR. WILKINSON (Harrogate) said they were concerned in the question of superannuation, and when anything definite was done in the matter, the members would be informed.

This ended the discussion on the report and balance-sheet, which were then adopted.

MR. TURNBULL (Tynemouth) asked for another discussion *in camera* next year, on heating and cooking, also that the exhibition should be repeated, and this was supported by other members.

MR. R. A. CHATTOCK (Birmingham) intimated that the Council would consider the question.

MR. BURNETT (Barrow) urged the Council to take up the question of protecting its junior members in the matter of salary and conditions of service. MR. EDGCOME, the President, in replying, offered as an explanation for holding meetings, *in camera*, that it was really to avoid giving unnecessary offence to contractors and manufacturers. The term used was unfortunate, and had been misinterpreted by the Press.

MR. FRANK AYTON (Ipswich), referring to his previous suggestion for the formation of a committee on electric vehicles, submitted a resolution that a committee should be appointed by the Council to consider and adopt measures for extending the use of the battery vehicle, and that it should be empowered to co-opt engineering and manufacturing representatives and others to assist.

This was supported by Messrs. SEABROOK (Marylebone), VIGNOLES (Grimsby), and WILKINSON (Harrogate), and carried without dissent.

A private discussion then took place on the I.M.E.A. Bill.

Lead Poisoning.—In the report of the Medical Inspector of Factories for 1912, it is stated that in the manufacture of electric accumulators the creation of dust is inseparable from many of the operations, and it is evident that, with the increased number of persons employed, there is risk of one worker inhaling dust and fumes produced by another. Extension of the requirement of exhaust ventilation to such processes is being pressed for in the processes of lead burning, filing and finishing. In one factory visited by the Inspector 12 years ago, when some 20 persons were employed, there are now nearly 200. Examination of the health register gave the following results as regards the number of persons in the different processes showing signs of lead absorption :—

	Number examined.	Number marked showing lead absorption.	Per cent.
Casting	28	4	14
Pasting	27	6	22
Forming	16	5	31
Lead burning	19	7	37
Filing, finishing, cleaning ...	29	9	31
Packing...	16	3	19
Others	24	5	21
Total	159	39	24·5

Exhaust ventilation locally applied below the breathing level opposite each worker and as near as was practicable, without interference with the work, was required wherever filing or lead burning was done at fixed stations.

During the year 38 cases of lead poisoning were notified in connection with electric accumulator works, of which one was fatal. This is the largest number since 1901, and compares with 24 cases in 1911. Control of sources of dust is again pointed out as the most important factor in bringing about a reduction in the number of cases.

ELECTRICAL ACCIDENTS IN 1912.

(*Continued from page* 14.)

Of the accidents in the use of portable apparatus, 31, or half the total, were due to damaged flexible conductors, the wires short-circuiting and burning the men holding them. In one case the man, in order to have his hands free whilst working, had coiled the flexible wire round his neck. In the case of one accident, a portable lamp was being used in the pit of a motor garage, and the fusing of the wires ignited petrol vapour, severely burning two men. Most of these accidents would be prevented by systematic examination and proper maintenance of the wires, especially in places such as engineering shops and shipyards, where the wires are subjected to very rough usage, although often the protecting covering of the wires is of poor quality to start with. One accident was due to the non-earthing of the metallic armouring of the flexible conductors. Apart from the trouble in having to earth metallic armouring, this form of protection is often less satisfactory and durable than other non-metallic coverings. Nineteen accidents were due to the use of improperly constructed connectors, and would have been avoided by the use of connector plugs with hand shields, as described in my former reports. Some were due to the use of "adapters" for connecting to lampholders in the place of proper wall connectors. Two further accidents were caused by persons attempting to connect the wires of portable lamps to the circuit without any connector at all. Eight accidents were due to the use of improperly constructed hand lamps. Two were due to the absence of a proper cord grip in the handle. Two further fatalities occurred which are not included in the above tables, as the medical evidence was not sufficiently definite in regard to the cause of death. In one case the man, aged 42, who had been seen at work a few minutes before, was found lying on a wet floor with an improperly constructed and non-earthed hand lamp, connected to a 230-volt alternating-current supply, lying about 2 ft. away from him. The post-mortem examination showed that there was no indication whatever that he was liable to sudden death from natural causes. He was a robust man, muscular and well-nourished, and there was nothing to show the cause of death, the verdict at the inquest being "sudden death from some cause unknown." In the other case, two men were working on a wet iron floor, and were using as a hand lamp a lamp in an ordinary metal lampholder not earthed, attached by flexible wires to an adjacent electric light bracket. The man holding the lamp shouted and fell down, and the other man on attempting to lift him received a shock. The verdict at the inquest was "death from hæmorrhage on the brain." In this case the voltage of the lamp was only 50, and possibly this low figure had an influence on the finding of the Court. The 50-volt circuit was, however, taken from an auto-transformer on a 240-volt circuit, and the shock might have been from the full voltage, or at any rate from some pressure considerably more than 50 volts. Some time afterwards I found the pressure from one conductor to the earth plate on which the men were standing to have been 130 volts. A prosecution was subsequently undertaken for breach of the Regulations in respect of the use of the non-earthed portable apparatus, and the occupiers were find and £5 costs.

In the next class—accidents due to unprotected conductors—in 12 cases the chief injuries were shock, and in 15 burns. A fatal case occurred to a lad who touched the conductors (460 volts D.C.) of a motor controller, the cover of which had been removed.

Of the accidents to skilled persons, described as "electricians" or "wiremen," due to working on live conductors, 12 were due to short circuits by the use of metal tools (*e.g.*, spanners, pliers, screw-drivers); one was due to measuring across live terminals with a steel rule. Most of these accidents could undoubtedly have been avoided, as the work need not have been done whilst the conductors were live.

Of the similar accidents to unskilled persons (*e.g.*, fitters, labourers) no fewer than five were fatal. One of these occurred to a labourer in getting up to an overhead crane. He caught hold of the trolley wires and could not let go. The current was switched off and he then fell to the ground, fracturing his skull. The second fatality occurred to an electrician's assistant who commenced to carry out some work himself instead of waiting for the electrician. He had taken the leads out of a motor (400 volts, three-phase) and apparently turned on the switch whilst holding the end of the wire. The third fatality occurred to a labourer getting hold of the crane trolley wires (440 volts, three-phase). He appears to have had no duties to take him up to the crane, and his presence there was unexplained. The other two fatalities occurred to two men engaged in painting steel standards carrying overhead power wires (6,000 volts), one man going to the assistance of the other. Their instructions were that the work of painting the standards was to be done on Sundays when the wires would be dead, and they had been warned and threatened with instant dismissal if they went up the poles without having previously ascertained that the wires were dead. With regard to the other accidents under this heading, some were due to the men having been put to work under dangerous conditions without supervision, and others to the men undertaking the work on their own initiative. Several were due to work being carried out close to live trolley wires of cranes.

The accidents in testing departments of electrical manufacturing works were mostly short-circuits causing burns, but four were shock accidents in high-pressure testing. Considering the amount of work done in these testing departments, the number of accidents is not great. Much of the work is carried out by apprentices or pupils for reasons which I have explained in former reports, the average age of the whole of the 32 persons injured being only 23 years. Some of the accidents were due to carelessness on the part of the workers and others due to faulty apparatus and worn-out cables used in making the tests. Many test rooms are also too small for the work carried on. In some cases the works have been enlarged and the output enormously increased without any increase in the accommodation for the testing departments.

Under the heading "Miscellaneous" there are nine fatalities. The first was a very unusual type of accident, as the victim appears to have received a shock from foot to foot whilst walking over electrically-charged ground. An electric lamp standard, consisting of a 2-in. iron pipe about 12 ft. in length, was planted in the ground out of doors, and was provided at the top with a metal bracket for an electric lamp. The system was 440 volts, three-phase, the lighting being by two lamps in series across one phase. Owing to leakage in the lampholder, the whole standard became electrically charged. The current was conveyed to the standard by overhead wires. The standard was erected over the foundations of an old chimney which had been demolished. Twenty inches away there was a water main in the ground 8 in. below the surface, and about 5 ft. away was an iron plate (about 4 ft. × 2 ft.) about 4 in. under the surface. The accident was investigated by T. K. Evans, and the following particulars are taken from his report:—

The fact that there was a leakage to earth was detected on the previous evening by a workman, and all hands were warned to keep clear of it till it could be set right. The next morning a man was wheeling a wooden barrow, and another man, seeing that the direction in which he was going would be close to the standard, warned him to turn back. The first man, however, said that he would risk it, and stepping forward gave a cry and fell. His nearest foot had not been within 5 ft. of the standard. Artificial respiration was started at once and continued for three-quarters of an hour with medical aid, but without success. The surface of the earth was wet and muddy. The leakage was subsequently definitely traced to the lampholder. The standard thus electrically charged appears to have charged up a well-defined patch of surrounding surface earth, while adjacent to this was an equally well-defined surface at the usual earth potential (no doubt owing to the proximity of the water pipe), so that within a space of 2 ft. 6 in. it was possible to bridge practically the full potential. Under the Regulations this metal standard should have been efficiently earthed.

The second fatality occurred at a "goliath" crane at a steel works. The crane driver, who appears to have been a competent person, had gone along the cross platform to carry out some repairs, where he would necessarily have had to touch the trolley wires. He had forgotten to pull out the crane switch, which would have made the wires dead.

In the third fatality, a sub-station on the factory premises was supplied with three-phase current at 2,000 volts by overhead wires 26 ft. above the ground. A jib crane had been temporarily erected. One man, in pulling the steel rope of the crane, put it into contact with one of the overhead wires. A second man also received a shock, and a third man, in running to his assistance, took hold of the handle of the crane and received a shock, with fatal results. The overhead wires were not part of the factory equipment, but were mains or service lines belonging to the power company. The fourth fatality occurred in the yard of a motor-car works. This works, together with the adjoining premises, had previously been occupied by another tenant, and there had formerly been electric light in one of the outbuildings. The wiring had been in iron piping. When the present tenants came into occupation, the premises were split up, and also the electrical installation. The light in question was not used by the present tenants; in fact, the fitting had been removed from the end of the pipe, the ends of the wires being left bare and the pipe had fallen out of position. A man took hold of this pipe to move it out of the way and received a shock, the ground being wet, and he was unable to let go. Another man who was with him ran to the main switch and pulled it out, but on returning found the current was still on; he managed, however, to cut the wire with a hammer. It transpired that the switch controlling the circuit was on the next door premises, and that the circuit had not been disconnected at the time that the premises were divided up. The current was 200 volts alternating. In the case of the fifth fatality, no electricity was used on the premises, but overhead wires, 500 volts, three-phase, passed over the ground to a colliery. A derrick was being erected near the wires, and a wire guy rope which a man was holding was brought into contact. The occupiers of the factory were not responsible for the wires, and evidently did not realise the danger, as a man had had a shock in a similar way the previous week. Probably the fact that no serious consequences ensued on that occasion led them to the belief that there was no danger. In the case of the sixth fatality, a new building was being added to existing factory premises, and an electric lift was being put in. The controller house for the lift was at the top of the building, and a workman engaged in cementing the floor was found lying dead with his neck against the resistances of the controller. The pressure was 230 volts direct current. The man should, of course, not have been allowed to lay the floor whilst the current was on the lift. The seventh fatality was again due to the erection of a derrick close to overhead wires, in this case 440 volts, three-phase. A wire rope between the winch and the pulley on the derrick made contact with the wires, and a boy taking hold of the rope was killed. The eighth fatality occurred in connection with building operations in extending an iron works. A labourer climbing up a lattice girder came into contact with the crane trolley wires, 400 volts, three-phase. The ninth fatality occurred through the

breaking of an overhead wire (440 volts, three-phase) during a gale in the night. The foreman noticed the wire lying on the ground at 6.30 in the morning, but did not realise that it might be dangerous. About 8 a.m. a boy having to wheel a barrow past the spot picked up the end of the wire and was killed. The wires were protected by fuses and although there were signs of arcing to the ground, the fuses had not blown. Artificial respiration was tried for two hours without success.

Another fatality, not due to electric shock and not classed as an electricity accident, occurred in the purifier house at a gas works, in which there was an electrically-driven crane for lifting the lids of the purifier boxes. Although the motor and controller were specially constructed to be gas-tight, ordinary collectors with sliding contact on bare trolley wires were made use of. A lid of a purifier had just been lifted and was being traversed across the purifier house when the cloud of gas from the purifier was ignited. The crane driver in the cabin of the crane was killed by the burns he received from the ignited gas.

Amongst the non-fatal accidents under this heading, the following may be referred to. One was due to the non-earthing of the winch for raising and lowering an arc lamp, the winch handle becoming alive. In a shipyard a man received a shock from an electric winch which was not properly earthed. Several other accidents were also due to the non-earthing of electrically-driven machinery. Another man received a shock whilst fettling a casting, another part of which was being electrically welded. In another case the man received a severe shock, rendering him unconscious, through picking up a broken overhead wire, 440 volts, three-phase. In another case a boy of 16 received a severe shock from a lamp bracket which had become charged. He was rendered insensible, and was brought round by artificial respiration. Another shock accident was due to a man trimming an arc lamp (220 volts alternating), the lamp being "protected" by a single-pole switch only. An accident which can hardly be regarded as electrical occurred in a motor-car works, where petrol vapour was ignited by a man touching the sparking plug of a motor with a metal oil can. He was wearing a celluloid collar, which instantly ignited, and he was severely burned.

After an interval of several years, in which no serious fires have occurred in public supply generating stations, there are three recorded during the year under review. One occurred in a high-tension station where a new high-tension switchboard had just been completed. The fire originated under the floor of the working platform, and was apparently caused by the breakdown of the insulation in a joint-box, in which a concentric cable from a turbo-alternator was split up into two single cables passing on to the switchboard. The arc was apparently maintained for some minutes before the plant could be shut down. Owing to its position and the resulting fire, it was impossible to get to the control board immediately, and the fire quickly assumed such proportions that the fire brigade had to be called in. Considerable damage was done to the control board of the new switchboard, the fire following the run of the cables. The supply of electrical energy was completely stopped for one night, but the duration of the stoppage would have been much shorter had not water got on to one section of the high-tension switchgear—a part of the old board which had not been replaced—necessitating a complete drying out before re-starting. Although the switchboard was chiefly affected, the fire was not caused by any fault in the design. Incidentally, the fire showed the value of teak as a material for switch-room floors. The floor, which was of this material, although burned away where the arcing occurred was, at a short distance away, practically undamaged, and did not lead to any extension of the fire. As the joint-box at which it was supposed the breakdown originated, had been tested a few days previously to three times the working pressure, the cause of the breakdown is unexplained.

The second fire occurred in a direct-current station giving a three-wire supply and a supply for traction. The fire originated below the switchboard gallery where the cables emerge from the cable trench and rise up the wall to the switchboard, and where also the shunt regulators were placed. It does not appear to be known precisely where the fire originated, but it quickly spread amongst the cables, and following them up through the space between the switch gallery floor and the wall practically destroyed the main three-wire switchboard on the gallery. In this case the arrangement of the cables and wires below the switchboard platform was very crowded, owing to the growth of the station since the supply was first commenced, some 12 years earlier, and gave little chance for saving the situation in the event of a fire once starting. This fire also resulted in a total cessation of the electricity supply and involved the hasty erection of a temporary switchboard pending reconstruction.

The third fire appears to have been primarily due to a man, working at the back of a traction switchboard, making a short circuit to the earthed metal framework. The switchboard was in a room adjoining the engine-room and on a higher level, and on the opposite side of the room was the three-wire general supply switchboard. The man was severely burned by the resulting arc and the coverings of adjacent cables caught fire. This fire was, however, put out by the staff, by means of chemical extinguishers. A few minutes afterwards, an alarm was given that smoke was coming up from the basement—two floors below—where the cables from the generating plant and the feeders passed through to the switchboards and to the street. It was found impossible to enter the basement on account of the smoke, and very quickly a fierce fire was raging. The fire followed the cables leading up to the switch-room, passing through the space between the floors and the walls left open for their accommodation, and completely destroyed both the traction and the general supply switchboards. The latter board was quite new, having only just been completed and put to work at a cost of several thousand pounds. There was nothing whatever of an inflammable nature about this switchboard, the fire feeding entirely on the insulating coverings of the cables. A battery was connected to the traction board, and no doubt contributed to the spread of the fire, as it was subsequently found to be completely discharged. The rate of discharge of the battery appears, however, not to have greatly exceeded the normal maximum rate of discharge, as the main circuit-breaker, which was on another switchboard and was found to be in order, had not come out. How the fire amongst the cables in the basement started is not apparent, but it may have been due to breakdown of insulation owing to momentary rise of pressure following on the original short circuit at the traction switchboard. The complete breakdown of the electricity supply in this case involved more serious consequences than in the others owing to a number of works being dependent upon it for power purposes. Temporary switchboards had again to be hastily constructed.

These fires, especially as coming after several years of apparent immunity from such disasters, afford object lessons of great importance to those in charge of or who are responsible for the equipment of electrical stations. In all three cases, it was the covering of the cables that burned and spread the fire, and although some of the cables were in so-called "fireproof" composition tubes, these appear to have been of little, if any use in checking the spread of the fire. That where the cables are in a covered trench or under a ceiling or roof, they are most readily attacked, has been further clearly demonstrated in the case of a fourth station fire which has occurred since the period covered by this report. In this last case the cables were in a subway some 6 or 7 ft. in height and were laid on insulators on racks on each side of the gangway. All the cables within about 2 ft. of the roof of the subway had their insulation completely burned off, but those nearer the ground were practically undamaged. In many of the older stations the cables and wires behind the switchboards and in cable trenches and subways are hopelessly mixed up, so that should a fire be started at any point it would be impossible to prevent it from rapidly spreading and involving the whole. It is a common practice in electrical stations for the cables to be taken from trenches or subways up the wall of the building to the switchboard gallery, the floor of the gallery being cut away, leaving a permanent opening some 12 in. wide all along for the cables to pass through. Two of these fires show the danger of this opening in the floor allowing the fire to pass upwards and involving the switchboards in the gallery or room above. So long as cables with inflammable insulation are used in electrical stations, it is obvious that some safer system of isolating and protecting them is necessary if the possibility of such disasters is to be prevented. There are no doubt difficulties in many stations on account of the large number of cables which have to be accommodated, but it might be practicable in many cases to separate the cables in channels of brick or stoneware in such a way as to prevent the spreading of a fire from cable to cable. The small wires for instruments, regulating resistances, &c., are often a source of danger, being poorly insulated and looped about anyhow at the backs of the switchboards. It is generally recognised that inflammable woodwork, particularly soft wood, should not enter into the construction of switchboards, yet I recently found a new high-tension three-phase switchboard in a public supply generating station practically enclosed in woodwork; the bus-bars were just below a matchboard ceiling, and the whole passage-way at the back of the open-fronted cells was enclosed by deal boarding.

(To be concluded.)

THE CAUSES OF FIRES IN CENTRAL ELECTRIC LIGHTING STATIONS, AND THEIR REMEDY.*

BY ANDRE GERARD.

CASES of the total or partial destruction by fire of central electric lighting stations have recently been somewhat numerous, especially in the United States and Switzerland. The repetition of serious fires, which deprives towns, and sometimes whole districts, of light and power during more or less extended periods has led those responsible for the management of generating stations to seek to discover the most probable causes of fire, and the remedies to be adopted for their removal.

The majority of modern central stations, whether hydraulically or steam-operated, are constructed of fireproof or incombustible materials—ironwork for the roof beams, tiles or slates for the roofing, and bricks, stone, or cement for the walls and floors. It would, therefore, seem, *a priori*, that only the machinery and accessories can act as feeders to a fire should an outbreak occur. It must not be overlooked, however, that iron and steel roofing material exposed to a violent fire is easily dislodged, owing to twisting under the action of the heat of the parts comprising it, and, in becoming dislodged, whole sides of walls may be dragged down.

Apart from the switchboards, there is little cause for fire in the power house of central stations. The windings and cables of the

* *La Lumière Electrique.*

machine may, possibly, catch fire, but such outbreaks are easily localised, and do not give rise to great heat.

In many recently-constructed power houses, a change more to be feared has been introduced by the adoption of filters to filter the air employed for the cooling of the alternators. These filters, composed of strips of cloth stretched across wooden frames form excellent additional fuel for fires, they being easily ignited. The flame, sucked along by the alternators, which play the part of huge fans, may quickly destroy the whole windings, and, owing to the excessive heat, cause seizing of the bearings of the steam turbines and generators, and so possibly bring about the destruction of the turbines.

In order to prevent such serious accidents, the filters should be placed some distance away from the alternators, which they keep free from dust, in a special fireproof compartment, which the station staff should not be allowed to enter. It is also well to cover the external air inlets to the filter chamber with wire gauze, as in this way the risk of the filter catching fire should an outbreak occur at the station, is diminished.

The conductors, which transmit the electrical energy for the auxiliary services and lighting of the station, should be carefully insulated, and enclosed, if possible, in metal tubes. The insulation of these circuits should also be frequently tested. The current should preferably be conveyed from the generators to the switchboard by copper bars arranged in perfectly watertight and fireproof channels. By adopting this method, the possibility of short circuits, which may arise in the armoured cables often employed for this purpose, and which frequently form long sustained arcs—one cause of fire—are avoided.

The section of central stations most liable to fire is the switchboard, where are usually grouped a large number of particularly inflammable materials, such as the oil of static transformers, the insulating blocks of measuring transformers, and the rubber with which the cables are covered.

A modern innovation in central station construction is to completely separate the switchgear from the power house, and to locate it in a separate and independent building. If the switchboard catches fire the power house is preserved, and a temporary system of cables can be quickly rigged up to maintain a supply of current to consumers. On the other hand, if an accident, such as the bursting of a steam pipe, occurs in the machine room, no harm is done to the switchgear. It is, unfortunately, not possible to adopt this excellent arrangement in existing stations, and, consequently, all that can be done is to make the switchgear as fireproof and incombustible as possible. If static transformers—which are particularly dangerous from a fire point of view, as they practically constitute oil reservoirs—are employed, it is advisable to shift them to a specially isolated part, the compartments in which they are placed being protected from any possible falling walls. The front of these chambers should be provided with folding iron gates. Contact thermometers, or thermo-electric couples, would inform the switchgear attendants as to the temperature of the oil in the transformers at work, and they could be given a warning of any excessive heating of the oil by means of an electric bell arrangement.

The oil switches and the alternator and feeder connections of switchboards also form an element of danger. From various tests that have recently been carried out, it appears that the oil of these switches may catch fire in either of the two following ways:—First, by progressive heating, due, for example, to a bad contact at the jaws of the switch, this leading to the rupture of the normal load of the alternator or of the feeders; under the action of the arc set up by the rupture, the oil, already highly heated, ignites. This firing does not, however, take place unless there is a shortness of oil, or unless there are openings in the switches, as, to cause combustion, there must be some air in the vicinity of the oil. Switches ought, therefore, to be kept well sealed and fitted with a visible oil-level indicator.

It has been noted that ignited oil tends to extinguish itself so long as it is not in contact with any wick. Therefore, anything that might act as a wick to feed the ignited oil should not be included in the construction of switches, and, above all, care should be taken to see that the cables leaving the switches are not covered with insulating material. A similar remark applies to the cables leaving static transformers. This first way in which the oil of switches may become ignited may be easily overcome if the station attendants will make themselves acquainted with the smell arising from the progressive heating of oil.

The second cause of trouble is the sudden heating up of the oil. This may take place when a short-circuit, broken by a switch, is not proportionate to the power lost on the short-circuit. There is little to be feared on this account between the switch and the alternator; indeed, it is almost impossible if the precaution is taken to equip the machines with instantaneous-acting reverse-current relays. It is, however, different as regards the break between the switch and the feeder. In case of a short circuit in a feeder, the automatic switch breaks not only the total energy being transmitted at that moment, but that multiplied by a coefficient of between three and four. Again, the extension, often rapid, of the capacity of central stations, is not always accompanied by a replacement of the switches originally installed, whereas their capacity ought to be changed to correspond to the increased capacity of the plant. The consequence is that more energy is transmitted through the switches than that for which they were designed, which may give rise to the sudden heating up of the oil already mentioned. Should the oil fire, it is possible for the switches to explode or burst, so spreading the flaming oil, and should any of it come in contact with combustible material, it will not only set fire to it, but the material will act as a wick to the oil, and so keep it burning. To prevent such accidents, each switch should be proportioned to the total power of the plant; in the case of large, modern central stations, this necessitates switches of a somewhat imposing size, with the result that, with the object of reducing the dimensions, what are known as armoured switches, enclosed in thick steel plates, and also compressed oil switches, which require less oil for an equal capacity, are being introduced.

It is always necessary to see that there are no combustible materials in the neighbourhood of the switches. The panels of the switchboard should be made of cement, or some similar material. The conductors should be bared to prevent the spreading of a fire. The wrapping of asbestos round rubber insulation should not be allowed, as asbestos forms an excellent wick for burning oil. The switchboard should be divided into several sections, completely separated one from the other by iron doors. The passages, where the switch panels are all on one floor, and the staircases, where they are on different floors, should be outside the building. If a fire breaks out in one of the sections of the switchgear, it could, in this way, be completely isolated from the neighouring sections, and the area of the fire confined. At the same time, it is advisable that the iron doors should be kept open, so that the attendants may be warned of any danger by the smell associated with copper and burning oil.

A feature of many central station fires, is that great clouds of dense smoke are rapidly produced, which quickly invade the whole building; this smoke, which arises from the numerous resinous materials involved in the fire, greatly impedes the work of the firemen, or the station staff, who are unable to enter the building to stop the machines or to switch off the cables and feeders. Every station should, therefore, be equipped with apparatus to enable men to enter buildings filled with smoke or unbreathable air. Some of the apparatus made for this purpose necessitates so long an apprenticeship on the part of a staff and so long a period to put on, that apparatus into which air is pumped is to be preferred. The helmets for central station use should be made of an insulating material; the pipes which convey the fresh air from the outside to the interior of the power house may be metallic, but that leading to the switchroom should be of rubber. According to this plan there would be in each station a double set of piping for each apparatus.

At the side of each machine in the power house, and also in the switchroom, there should be kept ready for use a number of hand fire-extinguishers. Apparatus of the liquid-jet type cannot, of course, be used if pressure still exists at the terminals of the machines or at the bars of the switchboard. In this case extinguishers of the powder type are to be preferred.

The location of the water hydrants for the fire service should be carefully studied. If a pressure water supply is not available, it will be necessary to construct a water tower, and, in addition, to provide auxiliary pumps equipped with self-contained motors.

In conclusion, it may be pointed out that it is not altogether advisable, for the simple purpose of reducing production expenses, to establish generating stations on too large a scale; from a fire point of view, it is preferable to divide a district up into sections, each with its own generating station, the network being, however, so connected up, that in case of a fire at one of the plants, the mains usually fed from it can be supplied from one of the other stations.

French Trade with the Electric Furnace.—The *Génie Civil* states that the exportation of bauxite, the source of aluminium, was 144,000 tons in 1912, as compared with 154,000 tons in 1911. England took 40,000 tons; the United States, 33,000; Holland, 31,000; and Russia and Germany, 26,000 tons each. The export of anhydrous alumina was 8,300 tons, against 8,800 in 1911, and of sulphate of alumina 423 tons, against 978. Aluminium was exported amounting to 6,600 tons, compared with 4,000 tons in 1911 and 4,100 in 1910, mainly to Germany and Switzerland. The export of calcium carbide increased from 5,058 tons to 6,225, largely for acetylene lighting in the French Colonies; 3,302 tons were imported. Over 3,000 tons of nitrate of lime and cyanamide were imported, the former coming from Norway and the latter from Switzerland. Ferro-silicon exports amounted to 3,766 tons, and various iron compounds to 6,531 tons, most of the former going to Germany and Belgium, and of the latter to England and Switzerland. The exports of chlorate of potash were 1,746 tons and of chloride of lime 13,000 tons.

Troubles Due to Non-Use of Circuit-Breakers.—In the *Electrical World*, F. W. Harris points out that a common source of complaint is the heating of the contacts of circuit-breakers after the instrument has been in service for a long period. These breakers, as commonly constructed, have a laminated brush made up of thin leaves of copper, and any temperature over a certain very well-defined maximum will result in the brush becoming soft and losing its elasticity. Therefore the heating becomes very much worse, rapidly approaching a crisis which results in a more or less total ruin of the brush and sometimes a shut-down of the plant. In a certain case an examination of conditions showed that the troublesome circuit-breakers were connected on a circuit that was never opened except upon dead-short-circuit conditions, and these conditions did not obtain more than once or twice a year. The whole trouble was traced to a gradual oxidation of the contacts and to the fact that the troublesome circuit-breakers were never opened and closed to rub off the oxide. It was found that if the instruments were opened and closed a few times on Sundays it was possible to keep the contacts bright.

EDUCATING THE PUBLIC IN THE USE OF LIGHT.

THE Illuminating Engineering Society of New York has recently published a booklet entitled "Light: Its Use and Misuse," which is designed to educate the public in the principles governing good lighting, and in the nature and defects of bad lighting. Under a slightly extended title the Illuminating Engineering Society of London has since published essentially the same work "slightly modified to suit the needs of this country." It is hard to see why a treatise of this description should require adapting to the needs of this country in contradistinction to those of America, and such differences as actually exist between the two editions lie in the arrangement of the text and blocks, and are of no vital importance. Nevertheless, the phrase quoted is unfortunate, and is likely to remind readers of the fate awaiting the patient when doctors disagree. In respect of grammar and arrangement of matter we prefer the English edition, and the latter is certainly more accurate in its technical statements and advice.

In both editions the matters dealt with include a brief discussion of the mechanism of the human eye and the effect on it of various lighting conditions; the dangers of flicker and glare; the distribution of illumination; the choice and arrangement of globes, shades and reflectors; and the amount of illumination necessary. These matters are dealt with very satisfactorily, but we find no reference to the evil effects of "cut-glass" bowls (as distinct from glassware scientifically designed on the Holophane principle), or to the dangers of heating the eyes by lamps placed near them—which danger often exists though the luminous radiations are properly screened. As regards the illumination necessary for reading, it is interesting to note that 2 or 3 ft.-candles are now held to be desirable. It is not long ago that 1 ft.-candle was the standard reading allowance.

A special feature in both editions are the illustrations, which are intended to present to the reader concrete ideas on the subject in hand. The choice of illustrations is rather better (from the point of view of instructing and convincing the reader) in the English than in the American edition, but a number of the figures are the same in both cases. The photographs reproduced illustrate the arguments and recommendations made in the text, but they do not always do so fairly. The use of photography in representing lighting conditions is open to grave risks. Quite apart from the fact that the photographic plate "sees" rays which are invisible to the eye, and is unaffected by other rays to which the eye is sensitive—quite apart from this important difference in colour-sensitivity, it is practically impossible to secure on a photographic plate or print that impression of light and shade which would be received by the human eye viewing the actual scene represented.

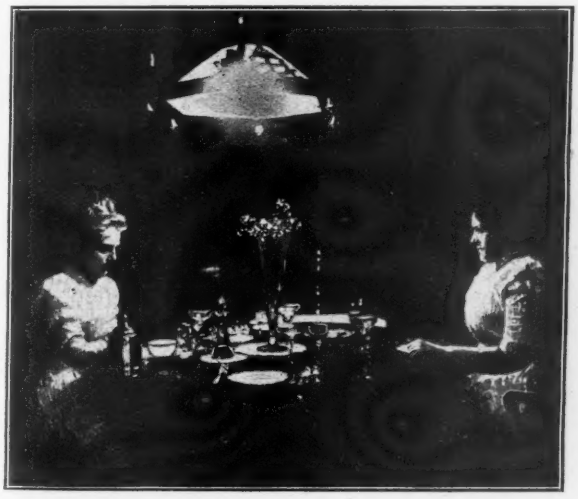


FIG. 1.

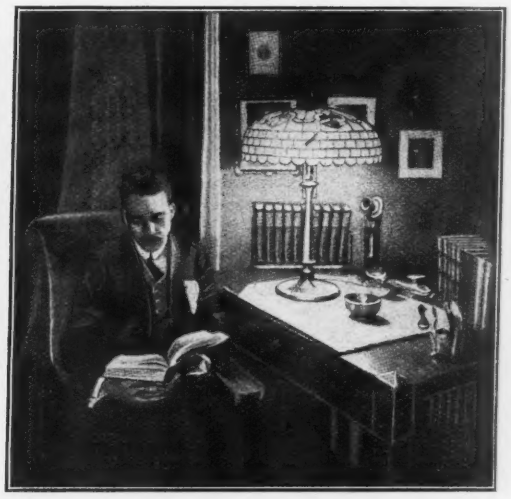


FIG. 2.

Consider, for instance, the dining-room scene reproduced in fig. 1. It is impossible that in any room thus lighted the eye should find the surroundings so inky and the shadows so deep as they are shown in this illustration. The lighting is undeniably bad, but, whereas the human eye is by nature very accommodating, the camera lens takes in the whole scene under certain conditions, fixed in each case, and were a sufficient exposure given to bring out those background details easily visible to the eye, the light from the lamp itself would fog hopelessly the whole upper portion of the photograph. Suspending chains above inverted lighting fittings are completely "fogged out" in a photograph given sufficient exposure to record the less intensely lighted parts of the field. In the American illustrations, details thus lost have been (rather crudely), sketched in before making blocks, while in the English edition they are left invisible. Actually, of course, the eye would have no difficulty in seeing the parts in question. The human eye has a very much smaller field of focus than the camera lens, and the violent contrast shown within the few square inches of a photograph is far less noticeable to the eye when viewing a "life size" object (only part of which can be clearly focused at any one moment), than when regarding a small print, practically the whole of which can be sharply focused at once by the eye. Any reader viewing the illustration in question will readily agree that the lighting shown is heinous, but few will realise that the conditions represented are identical with those prevailing in their own rooms, and therein lies the root of our objection to many of the illustrations not only in these but also in other illuminating engineering publications.

A further danger, to which illustration of lighting conditions by half-tones is exposed, is that there may be a marked distinction between pulls from the same block. For instance, in illustrating two adjacent cabinets—equally lighted but respectively lined with light and dark materials—the English brochure shows much worse conditions in the dark-wall room than does the American print from the same block. A similar distinction is noticeable between the blocks illustrating diffusion by opal and ground-glass spheres in the two publications. On the whole, the English illustrations represent interior lighting conditions more nearly as they would appear to the eye.

With the general statements and recommendations made in the text we are in agreement, though, in the American edition, statements, which appear conflicting to the layman, are made in various places without its being clearly explained what different conditions and needs have to be covered in the several cases. In seeking to appeal to the lay reader, the American treatise perpetrates several unnecessary technical inexactitudes. For instance, the optic nerve does not "send along the picture" (on the retina) "to the brain for notice," nor, in the dim light, does "the focusing muscle vainly hunt for some focus which may make objects look clear." Again, the American author attributes the harmful effect of reflection from glossy paper to the unusual direction from which it proceeds: it would have been more correct and useful to have attributed the evil to the high intensity of the specular reflection and the uneven illumination of the field of view.

Both the booklets under review are printed with non-glossy ink on unglazed paper. This is a practice which we trust will extend; the examples before us prove conclusively that excellent half-tone reproductions can be made on unglazed paper, and it has hitherto been an anomaly that illuminating engineering journals have employed the glossiest of papers while pointing out its defects in their columns.

The lamp arrangement shown in fig. 2 herewith is given in the American edition as being good for reading purposes; it is stated that "no light directly hits the eyes, and no glare is reflected from the book." In our opinion, the arrangement is distinctly bad. The lamp is too far to the front; it should be behind and above the reader. Under the conditions shown, a very trying side light enters the reader's left eye; if the book paper is glazed, it will certainly "glare," and the illumination on the pages is patently uneven. Unless the reading lamp is above and behind the reader's shoulder, it should be square in front of him, and the lamp should be provided with an opaque diffusing reflector of such depth that the lamp cannot be seen without actually looking up into the shade. It is practically impossible to avoid glare or specular reflection from glazed paper, except by preventing the incidence on it of any undiffused light.

The authors of these books have wisely avoided any discussion as to the relative merits of various types of lamps; this controversy, though of prime importance in a deeper study of the subject, need not be brought into a treatise designed to educate the public in the first principles of good lighting. We are in entire agreement with the general aims of these pamphlets, and, because we

consider the work embarked upon to be of national importance, we have discussed at some length the most serious of the imperfections in the publications. We consider the English edition to be distinctly the better, and we hope and believe that this treatise and the ones which are later to appear, dealing with different applications of illuminating engineering more specifically, will direct widespread attention to the evils attending bad lighting and lead to the general attainment of good illumination.

THE "PARAGON" PETROL-ELECTRO-MECHANICAL TRANSMISSION SYSTEM.

THE tremendous revolution in street and railway transit brought about by the use of electricity for motive power has for years led to investigations by many accomplished engineers throughout the world, and in connection with the application of the internal-combustion engine to transport purposes, the work of Mr. William P. Durtnall has exhibited a striking novelty and a high degree of ingenuity born of practical experience. Many patents, both British and foreign, go to make up what Mr. Durtnall has been pleased to name the "Paragon" system; one of the most interesting is British Patent No. 6,758/1909, a practical description of which, and of the method of operation, is given below.

Fig. 1 shows the general lay-out of the plant as proposed for the propulsion of motor vehicles such as omnibuses, road lorries, and other vehicles where light weight and high efficiency are of supreme importance.

As will be seen in this lay-out, the prime mover A consists of a six-cylinder horizontal opposed "Paragon" cycle (silent) petrol engine, which we shall deal with further in a future issue; this engine is fitted with the most modern improvements, including ball bearings of a special type. The engine runs at 800 R.P.M., and in the present instance drives a four-pole synchronous three-phase alternating-current generator B, through the coupling C. The engine shaft is continued through to the machine, which Mr. Durtnall calls the clutch-motor D, and to its revolving outside cast-steel case the engine is also coupled. Separated by an air-gap shown at O, there is inside the case D a squirrel-cage rotor or secondary member E, which is mounted by means of ball journal and centring bearings shown at N, on the driven or cardan shaft shown at F; this shaft is coupled by means of the ordinary final drive to the axle, and in connection with this final drive there is a very interesting reverse motion brought about by two bevel wheels, always in mesh, one on each side of a driving pinion, the axle being given an ahead or astern motion as may be desired, by simply engaging either driven bevel wheel with a dog clutch mounted on a squared part of the main axle. The clutch is operated by means of a fork and a lever which is carried right forward to the driver's seat, from which it is easily operated when desired. Mounted inside the power-driven clutch-motor case is a small, but powerful, magnetic-clutch coil half shown at G, in which is the exciting coil H; it will be observed that the air gap shown at O, allows the engine to run without driving the cardan shaft F, when there is no excitation, and it is arranged that by means of the magnetic clutch G, the clutch armature shown at I, can be drawn over against the coil half G, and so mechanically short-circuit the air gap O; when so connected the engine can deliver its mechanical power direct to the final drive and axle—the electrical machines, and the slip-rings shown at J, then running only as fly-wheels, and unexcited. The slip-rings shown at K, take the exciting current to the four-pole revolving magnet of the synchronous generator, whose frame is fixed to the chassis frame L; the slip-rings J are electrically connected with proper connections through a hollowed portion of the engine shaft, and up through the casing of D, to the eight-pole three-phase star-connected winding shown in the case at M, which is, of course, laid in slots in the laminated core.

The manner in which this combination operates is as follows:—It must be assumed that the engine A is running at 800 R.P.M., and is driving the revolving field of the synchronous generator B, together with the slip-rings J and K, solid with the cast-steel case of the clutch-motor D, and for the sake of clearness we will assume that, looking at the plant from the engine end, the revolutions are in the counter-clockwise direction; no movement is given to the vehicle owing to the fact that no excitation has, so far, taken place, and therefore the magnetic effect is absent at the air-gap O.

For the first speed, direct-current is put on the slip-rings K from the exciter, which is not shown here; three-phase alternating current at, say, 26 cycles, is taken off from the generator armature of B, and is coupled to the slip-rings J, which are electrically connected to the eight-pole winding M; the current is set in such a direction, that the consequent magnetic flux travelling in the mechanically-driven laminated core of the clutch-motor D, is revolving in a clock-wise direction at just half the speed at which D is being mechanically driven. It must be remembered now that the rotor E up to now has been stationary, but at this moment it is suddenly surrounded by eight powerful magnetic poles, which are being driven mechanically by the engine, at a revolution speed of 400 R.P.M. only, owing to the fact that the four-pole generator (driven at 800 R.P.M.), is supplying the exciting current, producing the clock-wise revolving magnetic field in the core of D, which is being mechanically driven by the engine in a counter-clock-wise direction. Consequently in the squirrel-cage winding a high E.M.F., and current is generated at a frequency of, say, 13 cycles, with the result that the rotor and, consequently, the cardan shaft is started and pulled round by the engine in a counter-clock-wise direction; the arrangement thus takes the form of a very efficient magnetic clutch, with a high torque at starting, gradually falling off as the rotor runs up to just behind the synchronous speed of 400 R.P.M., which would represent a vehicle speed of, say, four miles per hour.

The vehicle being accelerated to the above speed, and having kinetic energy in itself, the exciter is taken off the slip-rings K, and consequently the whole system falls to a no-voltage condition; in that state the leads from the generator B to the slip-rings J, are disconnected, the member D is still driven by the engine at 800 R.P.M., and the rotor E is driven round in the same direction counter-clock-wise by the vehicle by means of the cardan shaft F. The exciter is then connected to the clutch exciting coil H, by means of one only of the slip-rings J (frame return), with the result that the clutch armature, which is mounted on suitable pins on the rotor E, is attracted against G, and the vehicle is consequently further accelerated to a speed of eight miles per hour; the engine is then driving direct through to the axle at the engine speed of 800 R.P.M. This is, of course, the most efficient speed, and in town work is almost always in action.

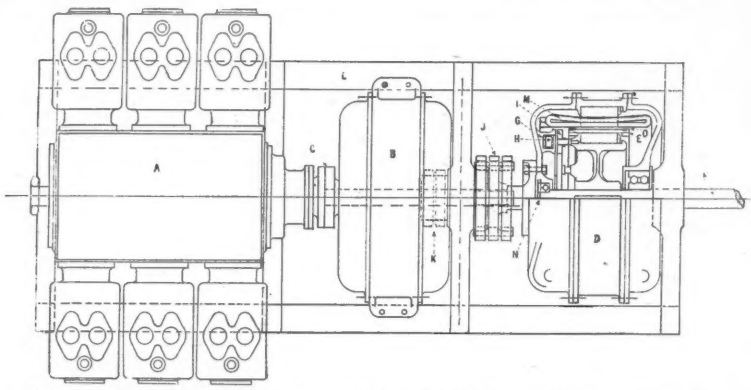


FIG. 1.—"PARAGON" PETROL-ELECTRO-MECHANICAL SYSTEM OF TRANSMISSION.

For the third speed the exciter is taken off the exciting coil H, and the clutch armature flies back into its off position; both the rotor E and the case D are running then at the same speed of 800 R.P.M., the rotor being driven by the vehicle and the case by the engine. The connections are now made from the three-phase armature of B, to the slip-rings J, but in this instance two of the phases or leads are reversed by means of a change-over switch arranged for in the controller. The exciter is put on the slip-rings K, and three-phase current at, say, 26 cycles is connected to the eight-pole winding in the case D, but in this case the resulting magnetic flux travels or revolves in the laminated core of D, at a speed of 400 R.P.M. ahead of the engine or core speed, in the counter-clock-wise direction looking at same from the engine end; the result is that the rotor E is accelerated in speed and runs up just below the synchronous speed of 400 R.P.M., compared with the mechanically-driven case D, or 1,200 R.P.M. absolute speed, which represents a vehicle speed of, say, 12 miles per hour, the proper top-speed of such a vehicle as a 3½-ton motor omnibus.

The action at this speed is very interesting owing to the fact that part of the mechanical power of the engine is being transmitted across the air-gap, and part of the work is then being done by the rotor E, climbing (as it may be put) round magnetically by means of the revolving flux in the core of D. About ·6 of the mechanical power is so delivered mechanically, and ·4 is delivered electrically, truly an electro-mechanical combination.

It will be observed that no fly-wheel is shown, nor is one required; as stated above, the members B, J, and D, have more than enough fly-wheel effect. The clutch-motor is driven round at 800 R.P.M. and is sure of very effective cooling, consequently the electrical machinery is very light per unit output for a given heating limit; there is no question concerning the efficiency of the power transmission, and consequently the total weight per horse-power transmitted is extremely and unusually low, and the mechanism is, comparatively speaking, cheap.

Although this lay-out of the "Paragon" system is shown as an ingenious "electro-mechanical" power transmitting system for the purposes named, we shall, at a later date, describe another lay-out for the application of this system, in which the whole power can be transmitted entirely electrically in connection with the "Paragon" gas-electric tram-and-rail-car system which, by a judicious combination of Mr. Durtnall's inventions, promises to be of great interest to those who have the problem of town and city transport under consideration.

PROCEEDINGS OF INSTITUTIONS.

Faraday Society.

DEMONSTRATION OF THE HERING "PINCH EFFECT" ELECTRIC FURNACE.

DR. CARL HERING, the well-known American electrochemist, who has been on a visit to Europe, gave a demonstration recently to the members of the Faraday Society of a small working model illustrating the principle of his application of the pinch effect to the heating of furnaces. The demonstration took place at the Northampton Polytechnic Institute.

In every conductor carrying an electric current, there is a force tending to crush the conductor, and if this conductor is a liquid, its cross-section will contract. The force is proportional to the

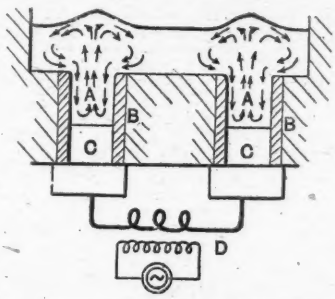


FIG. 1.—PRINCIPLE OF THE HERING FURNACE.

square of the current, and it consequently attains considerable magnitude when large currents are flowing. The tendency of modern engineering practice is entirely in the direction of extremes of magnitude, so that the employment of enormous currents in the electric furnace is only one further interesting illustration of that tendency. To return to the pinch effect, if the liquid conductor carrying the big current is in a tube with open ends, the liquid will be squeezed out at the ends; and if, by the action of gravity, for example, more liquid can flow in to take the place of that squeezed out, a continuous circulation of hot liquid will be kept up. It is this effect which is made use of by Dr. Hering for converting electrical energy into heat in his furnace and conveying that heat rapidly and automatically into all parts of the molten substance under treatment in the furnace.

The principle of the furnace is clearly shown in fig. 1, where A A represent diagrammatically the tubes in which the pinch effect takes place, and C C are the electrodes. The small experimental furnace shown in operation at the Northampton Institute is represented in fig. 2. It was merely used for melting lead, and was only intended to illustrate the action of the furnace and to show the pinch effect in operation. The feature that particularly struck one was the obvious rapid circulation induced in the body of the lead, and the ease, smoothness and uniformity with which the little furnace seemed to operate, but nothing can of course be said about efficiency as a result of these casual observations. One certainly was left with the impression, however, that heat was being generated and diffused as quickly as possible, and this by allowing little opportunity for losses is a necessary condition of high heat-efficiency. It was further noticeable that the temperature of the furnace was under good control, and it would appear that one could without difficulty get just the temperature required, and no higher. The actual limit to temperature was stated to be only determined by what the refractory material of the tubes—usually made of magnesite—could stand, and we were told that a dazzling white heat had been attained. The current density in the resisters was stated to reach a magnitude of something like 6,000 amperes per sq. in. One would imagine that the weak point in the furnace would be the resister tubes, but Dr. Hering assured us that there was very little wear on them in practice, and in any case they were easily replaced during a week-end close-down.

At present no figures as to efficiency or costs are available; a 3-ton furnace is in course of construction, and presumably the tests made with this will be published in due course. Until we have such figures no final opinion can be expressed as to the possibilities of the Hering furnace. As to its uses, Dr. Hering stated that it had been used to refine steel, and he gave instances where it had easily eliminated the whole of the sulphur from the charges. It should be noted that the furnace can be worked with either an oxidising or a reducing atmosphere. If the high temperatures claimed, and the rapid circulation noted in the small furnace can be attained in practice on a large scale, there ought to be little difficulty in obtaining a homogeneous steel free from "mechanical" impurities. It is, however, a little difficult to understand how "chemical" impurities are going to be removed by slag-action, seeing that the heating takes place from below the slag, and that the latter will always be at a lower temperature than the steel. Dr. Hering stated that resister tubes could easily be fitted to existing open-hearth furnaces, and if this is found to be practical and healthful it may be that the principle of the furnace will have a future in conjunction with other forms either of combustive or of electrical heating. Other

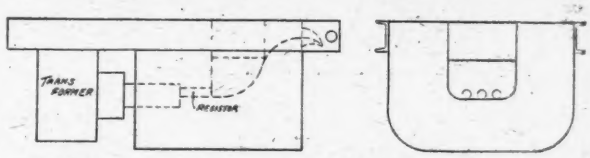


FIG. 3.—ARRANGEMENT OF THREE-PHASE HERING FURNACE.

uses suggested, some of which have been tried on a small scale, are for melting brass and bronze and for zinc reduction. As to the novelty and ingenuity of this application of the "pinch" effect there can be no question, and all electro-metallurgists will await with very great interest the results of the tests that will be made with the process when the large furnace contemplated shall have been built and tried.

Fig. 3 shows diagrammatically the form of the furnace as it will be used in practice, in this case arranged for a three-phase current

Electric Marine Propulsion.

AT the summer meeting of the INSTITUTE OF NAVAL ARCHITECTS, at Glasgow, Messrs. John Reid and H. A. Mavor presented "A Case for Electric Propulsion." The writers urged that the development of the canal barge presented a problem of much greater interest and importance than might at first sight appear. No one who travelled on the great rivers of Europe could fail to observe the immense traffic which they bore and the remarkable way in which the vessels employed in such traffic had been designed to suit local conditions and requirements. It was so also on the great North American inland waterways, the importance of which, as affording the only system of transportation which could compete with the railroad, had been very generally recognised. The functions performed by electric equipment were thus defined: (1) It adapted the speed of the engine to the speed of the propeller; (2) it combined the power of separate engines and applied the whole to a single propeller, with perfect freedom to use either or both power units; (3) it provided a simple and easy reversal of the propeller, while leaving the engines running in one direction at constant speed; (4) it also provided ready means of distant control, should this be required. It would be seen that mechanical gearing could perform only the first of these functions, and for this reason it was anticipated that, compared with a mechanically geared or direct-connected Diesel engine equipment, the electrical equipment would offer very material advantage in the operation of the vessel in the special circumstances under which it was placed. In the United States, Mr. Emmott, of the General Electric Co., had

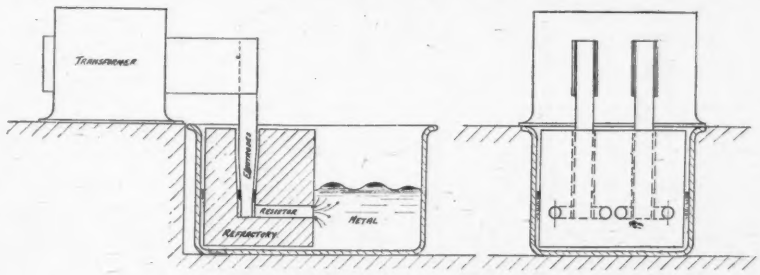


FIG. 2.—SECTION OF EXPERIMENTAL FURNACE.

shown the suitability of electric propulsion for a deep-sea collier of 7,000 H.P., for which the equipment had already been completed and tested, with the most brilliant results. The success which had attended the introduction of the geared turbine and the hydraulic transformer was of good augury for similar success with electric transmission. Electricity seemed to offer a means of solving certain difficulties in the power question which were, after all, only components of a problem which, in one form or another, long confronted the marine engineers, viz., how to generate power in a given vessel independently of the means used for propulsion, enabling the sources of power for all purposes to be concentrated in a central station with a single economical and easily controlled system of distribution, by which the power generated for any particular purpose might be exactly adjusted to its requirements.

Whitefield (Lancs.) Electric Lighting.—The Council has decided to apply for sanction to borrow £735 to cover new buildings and alterations, including electric lighting.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

14,433. "Lamp-making machines." ALLGEMEINE ELEKTRICITATS GES. (Convention date, June 21st, 1912, Germany.) June 23rd. (Complete.)

14,459. "Operating mechanism of sand-discharge valves for electrically-propelled vehicles." J. F. SIMPSON. June 23rd.

14,473. "Automatic electric fire detector, extinguisher, and fire brigade call." T. G. V. BLAKEY and W. FISH. June 23rd.

14,475. "Control of electric lighting and other circuits by means of a relay and switch or switches." J. F. HOUGH. June 23rd.

14,487. "Circuit arrangements for automatic and semi-automatic telephone systems." SIEMENS & HALSKE AKT.-GES. (Convention date, July 22nd, 1912, Germany.) June 23rd. (Complete.)

14,518. "Method for the electrical welding of metals by means of increased resistance." ALLGEMEINE ELEKTRICITATS GES. (Convention date, June 21st, 1912, Germany.) June 23rd. (Complete.)

14,524. "Telephone systems. W. AITKEN. (Addition to 16,906, 1912.) June 23rd.

14,532. "Device for controlling the speed of, or stopping by means of automatic contact with signalling apparatus, fog signalling, and improvements in and relating to signalling, and the application of same to railway trains, motors, locomotives, and like means of transit." A. FINDLAY and J. D. F. FINDLAY. June 24th.

14,562. "Electric liquid heaters." E. A. RAVES. June 24th.

14,567. "Incandescent lamps." BRITISH GRAETZIN LIGHT, LTD., and H. J. MEADS. June 24th.

14,587. "Electrostatic apparatus for separating and cleaning grits, grain, and the like," J. KRAUS. (Convention date, May 9th, 1913, Germany.) June 24th. (Complete)

14,591. "Electric gas lamps." F. SKAUPY. (Addition to 29,104/12.) (Convention date, November 27th, 1912, Germany.) June 24th. (Complete.)

14,614. "Number dial for automatic and semi-automatic telephone exchanges." SIEMENS BROS. & Co., LTD., and E. A. PETITHORY. June 24th. (Complete.)

14,628. "Switch keys for telephonic installations." INTERNATIONAL ELECTRIC Co., LTD. (Akt.-Ges. Mix & Genest, Germany.) June 24th. (Complete.)

14,631. "Microphones." INTERNATIONAL ELECTRIC Co., LTD. (Akt.-Ges. Mix & Genest, Germany.) June 24th. (Complete.)

14,633. "Apparatus for winding electrical machines." MASCHINENFABRIK OERLIKON. (Convention date, June 24th, 1912, Germany.) June 24th. (Complete.)

14,653. "Means for and methods of changing the frequency of alternating currents." A. M. TAYLOR. (Addition to 8,853, 1911.) June 25th.

14,699. "Electric heating apparatus." A. F. BERRY. June 25th.

14,729. "Loud-speaking telephone stations." H. WADE. (Elektrizitäts Akt.-Ges. Hydrawerk, Germany.) June 25th. (Complete.)

14,741. "Regulator for charging accumulator cells for use in motor-car lighting and starting and similar applications." W. H. SCOTT. June 26th.

14,742. "Electric starters for internal-combustion engines." W. H. SCOTT. June 26th.

14,760. "Lamps for artificially producing daylight effects." F. R. BOARDMAN, R. V. BOARDMAN and F. BOARDMAN. June 26th.

14,771. "Electric signals for railways." A. R. MUTTON. June 26th. (Complete.)

14,780. "Telephone table instruments or the like." G. MEYER. (Convention date, August 1st, 1912, Germany.) June 26th. (Complete.)

14,795. "Apparatus for sintering metals." R. B. WALLING. (Convention date, October 7th, 1912, United States.) June 26th. (Complete.)

14,796. "Electric motor-control systems." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) June 26th.

14,807. "Manufacture of metallic filaments for incandescent electric lamps." J. A. SCOULAR and DICK, KERR & Co., LTD. (Addition to 11,455/12.) June 26th.

14,816. "Electric switches." M. S. CONNER and A. R. KAHL. June 27th.

14,824. "Metal clip to attach safely flexible metal tube or other tubing or rodding, or cables, to tables or similar fixtures, as desks or cupboards and the like." R. ECKLES. June 27th.

14,892. "Vacuum tubes." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) June 27th.

14,909. "Electric heaters." W. R. RIDINGS. June 28th.

14,910. "Electric arc lamps." W. R. RIDINGS. June 28th.

14,927. "Arrangements for producing electro-magnetic oscillations particularly for use in radio-telephony." W. T. DITCHAM and GRINDELL-MATTHEWS WIRELESS TELEPHONE SYNDICATE, LTD. June 28th.

14,929. "Indicator, being a method of, and means for, more effectively attending to calls, signals and the like conveyed electrically." A. N. DRUMMOND. June 28th.

14,930. "Sterilising appliance for application to telephone mouthpieces and the like." S. L. LIGHTFOOT and C. W. AKERS. June 28th.

14,933. "Safety device for high-tension cables." W. VOIGT. June 28th.

14,941. "Apparatus for cooling electrical machines." AKT-GES. BROWN, BOVERIE ET CIE. (Convention date, February 24th, 1913, Germany.) June 28th. (Complete.)

14,942. "Electric or other horns for motor-cars and the like." A. GOODWIN and C. A. VANDERVELL. June 28th. (Complete.)

14,951. "Arrangements for controlling the feed of recording-instruments." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) June 28th. (Complete.)

CORRECTION.—In No. 13,980, appearing in our last issue, for W. C. Tucker read W. C. Turner.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

ELECTRICALLY-CONTROLLED POINT OR SWITCH OPERATING MECHANISM FOR RAILWAYS AND THE LIKE. R. V. Collins. 5,703. March 6th. (November 10th, 1911.)

METHOD OF JOINING METALLIC TUNGSTEN TO COPPER. British Thomson-Houston Co. (General Electric Co.) 10,888. May 1st.

RECEIVING APPARATUS FOR ELECTRIC TELEGRAPHS AND ELECTRIC SELECTIVE SYSTEMS. W. J. Lyons. 10,911. May 8th. (Cognate application, No. 13,599 of 1912.)

VACUUM CLEANERS. British Thomson-Houston Co. (General Electric Co. 13,374. June 6th.

INSULATORS FOR SECURING AND HANGING ELECTRIC FLEXIBLE CORDS, WIRES AND THE LIKE. W. Scholes. 13,401. June 7th.

PROCESS AND APPARATUS FOR REFINING METALS BY HEATING. A. Helfenstein. 13,577. June 10th. (June 10th, 1911.)

ACOUSTIC SIGNALLING DEVICES. A. Meckel. 13,615. June 10th. (June 10th, 1911.)

FANS OR VENTILATORS DRIVEN BY ELECTRIC MOTORS. J. Stone & Co. and A. H. Darker. 13,785. June 12th.

LAMPS OR LANTERNS. H. D. Wight, W. Blair and Sunderland Forge and Engineering Co., Ltd. 13,797. June 13th.

SWIVEL JOINT, PARTICULARLY APPLICABLE TO ELECTRIC LAMP AND OTHER SIMILAR SUPPORTS. J. Gourdon. 13,804. June 12th.

CONSTRUCTION OF ELECTRIC CEILING ROSE. G. Markt. 13,865. June 13th.

ELECTRIC STARTING AND REGULATING SWITCHES. G. O. Donovan. 14,086. June 17th.

SWITCHES OR SWITCH ARRANGEMENTS SUCH AS USED FOR STARTING OR CONTROLLING ELECTRIC MOTORS. F. Broadbent. 14,088. June 17th.

COMMUTATING DEVICES FOR DYNAMO-ELECTRIC MACHINES. M. Deri. 14,236. June 18th.

SYSTEM OF ELECTRICAL WELDING BY MEANS OF INDUCTION CURRENT. W. Sokoll. 15,216. June 29th.

ELECTRICAL HEATING ELEMENTS. Simplex Conduits, Ltd., and L. M. Waterhouse. 15,275. July 1st.

NAME PLATES AND ELECTRIC PRESS BUTTONS. B. Bonnin. 15,841. July 6th.

DISTRIBUTION OF ELECTRICITY BY ALTERNATING CURRENTS. A. W. Ashton. 17,336. July 26th.

SELF-REGULATING DYNAMO-ELECTRIC MACHINES. C. A. Vandervell and A. H. Midgley. 17,838. August 1st.

LAMP OR FLASH SIGNALLING APPARATUS. A. H. Hunt. 17,849. August 1st.

AUTOMATIC ELECTRIC CUT-OUT SWITCHES. R. Winterhalder. 19,164. August 21st.

AUTOMATIC REGULATING DEVICES FOR USE IN CONNECTION WITH VARIABLE-SPEED DYNAMOS. Compagnie Francaise pour l'Exploitation des Procedes Thomson-Houston. 19,537. August 26th.

SHADE SUPPORTS FOR ELECTRIC INCANDESCENT LIGHTS. J. N. Mollett and E. E. Edwards. 19,621. August 28th.

ELECTRIC ARC LAMPS. A. H. Railing and A. E. Angold. 21,411. September 20th.

DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. and F. P. Whitaker. 21,762. September 24th.

SPARKING PLUGS. W. J. Charles. 22,387. October 2nd.

MECHANICAL AND ELECTRICAL FOG-SIGNALLING APPARATUS. T. Gibson, G. A. Farmer and E. Read. 22,424. October 3rd.

ADDITION TO SPARKING PLUGS. F. A. L. Johnson. 23,605. October 16th.

SIGNALLING INSTALLATIONS, MORE PARTICULARLY ADAPTED FOR FIRE ALARMS. Siemens & Halske Akt.-Ges. 24,037. October 21st. (October 21st, 1911.)

SAFETY DEVICE FOR ELECTRIC MACHINES. Siemens Schuckertwerke G.m.b.H. 28,483. December 10th. (December 11th, 1911.)

ELECTRODE FOR TREATMENT OF THE INTERIOR CAVITIES OF THE HUMAN BODY. Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges.) 28,645. December 12th.

ILLUMINATED FOUNTAINS. J. Pietsch. 29,099. December 17th.

RAILWAY SIGNALLING SYSTEMS. C. A. Allison. (Wooding Railway Warning Device Co.) 29,238. December 19th.

METHOD OF ADJUSTING ELECTRIC METERS. O. T. Blathy. 29,566. December 23rd. (June 20th, 1912.)

1913.

SUBMARINE SIGNALLING APPARATUS. S. Lake. 26. January 1st.

ELECTRICAL TESTING APPARATUS. A. W. Brown. 178. January 3rd.

DISINFECTING APPARATUS FOR TELEPHONES AND THE LIKE. L. Block. 411. January 6th.

ELECTRIC IGNITION SYSTEMS FOR INTERNAL-COMBUSTION ENGINES. C. T. Mason. 4,670. February 24th. (April 22nd, 1912.)

AUTOMATIC REGULATING DEVICES FOR USE IN CONNECTION WITH VARIABLE-SPEED DYNAMOS. Compagnie Francaise pour l'Exploitation des Procedes Thomson-Houston. 5,020. February 27th. (August 26th, 1911. Divided application on No. 19,537 of 1912, August 26th.)

PORTABLE ELECTRIC BATTERY LAMPS. A. Menzel and B. Pordes. 6,573. March 18th.

A New Form of Illness?—The L.C.C. minutes this week contained the following very interesting particulars of the absence through illness of motormen and conductors during the months of February, March and April of this year, compared with similar information in respect of the same period of last year:—

	No. of men employed.	No. of men ill.	Total period of illness.	Average period of illness per man employed per month.
February, 1912...	5,313	457	5,435 days	1·02 days
February, 1913...	5,565	693	6,104 ,,	1·10 ,,
March, 1912 ...	5,325	343	3,557 ,,	·67 ,,
March, 1913 ...	5,636	709	7,380 ,,	1·31 ,,
April, 1912 ...	5,317	278	2,854 ,,	·54 ,,
April, 1913 ...	5,691	556	6,090 ,,	1·07 ,,

How much more interesting these figures would be if we could only know what was the nature of the illness which has, by its awful ravages, lead to so great an increase in casualties between the March of one year and the March of the next! If we only knew, *perhaps* we could find a remedy. Perhaps not! It has been suggested in some quarters that many people are now being "treated" for complaints that prior to the coming into force of a certain Act they stifled, or nipped in the bud, or neglected. But the L.C.C. men, on the whole, are a decent set of fellows, and the least we can say is that we hope that they will soon be well again.